SHRI RAMDEOBABA COLLEGE OF ENGINEERING AND MANAGEMENT, NAGPUR – 440013

An Autonomous College affiliated to
Rashtrasant Tukadoji Maharaj Nagpur University,
Nagpur, Maharashtra (INDIA)

PROGRAMME SCHEME & SYLLABI
2021 – 2022

B. Tech. (COMPUTER SCIENCE & ENGINEERING)

Published By

Dr. R. S. Pande

Principal

Shri Ramdeobaba College of Engineering & Management

Ph. : 0712-2580011 Fax : 0712 - 2583237

ISO 9001 : 2015 CERTIFIED ORGANISATION

About the Department

The Department of Computer Science & Engineering was established in 2002, is well-equipped with state-of-the-art infrastructure. The state of art infrastructure includes latest configuration desktops organized in four different laboratories. There are total 170 desktops with internet facility and inter-connected by a 24 hours server and CISCO router.

The department hosts 300 computers with internet facility. The 24X7 network managed with Cyberoam UTM firewall, and CISCO router offers intranet and internet connectivity. The computer laboratories have high-end servers of IBM and WIPRO along with industry-standard software, viz., Oracle, NetSim, Wireshark, AIX, Robotics Platform, IOT Kit and MSDN. The department promotes high-end computing through Open Source technologies and hosts NVIDIA DGX DL Workstation.

The Department has a distinction of consistently achieving above 95% results in the final year. Students are encouraged to appear in GATE, CAT, GRE and other competitive examinations which have resulted in increasing number of students clearing these exams.

Students teams of CSE have emerged winners at the Grand Finale of 2018, 2019 and 2020 editions of Smart India Hackthoan and have been excelling at the world renowned prestigious International Collegiate Programming Contest, ACM ICPC Asia West Regional Contents since 2015.

Departmental Vision

To continually improve the education environment, in order to develop graduates with strong academic and technical background needed to achieve distinction in the discipline. The excellence is expected in various domains like workforce, higher studies or lifelong learning.

To strengthen links between industry through partnership and collaborative development works.

Department Mission

To develop strong foundation of theory and practices of computer science amongst the students to enable them to develop into knowledgeable, responsible professionals, lifelong learners and implement the latest computing technologies for the betterment of the society.

Programme Educational Objectives

I. To prepare graduates to apply the broad set of techniques, tools, and skills from science, mathematics and engineering required to solve problems in Computer Science and Engineering.

The field of Computer Science & Engineering is a fast evolving field and caters to multiple disciplines. The focus is to imbibe necessary skill set amongst the students and develop competencies to solve basic computer science & engineering problem.

II. To prepare graduates to address practices in computer science and engineering using software development life cycle principles.

The department aims to develop good analytical and designing skills amongst students, while emphasizing on theoretical and practical aspects of computer science.

III. To provide adequate training & opportunities to work as teams in multidisciplinary projects.

The department aims at encouraging team spirit through projects which are multi- disciplinary in nature.

IV. To prepare the graduates to exhibit professionalism, communication skills, ethical attitude, and practice their profession with high regard to legal and ethical responsibilities.

The department recognizes the need for effective communication in students and strives to enhance this aspect. The department feels that apart from curricular studies, it is necessary to impart good moral values in the students so that they are aware of their social responsibilities.

V. To prepare graduates for engaging in life-long learning, such as post graduate study & certification courses.

The department encourages the students for higher studies and certification courses to keep track with the pace of technology.

Program outcomes (POs)

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication : Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and lifelong learning in the broadest context of technological change.

Programme Specific Outcomes (PSOs)

1. **Foundation of Computer System :** Ability to understand fundamental concepts of computer science & engineering, operating system, networking & data organization systems, hardware & software aspects of computing,
2. **Software development Ability :** Ability to understand the software development life cycle.

   Possess professional skills and knowledge of software design process. Familiarity and algorithmic competence with a broad range of programming languages and open source platforms.
3. **Research Ability :** Ability to apply knowledge base to identify research gaps in various domains, model real world problems, solve computational tasks, to provide solution for betterment of society with innovative ideas.

TEACHING SCHEME FOR FIRST YEAR (SEMESTER I & II)
BACHALOR OF ENGINEERING

GROUP 1: SEMESTER-I/ GROUP 2: SEMESTER-II

Sr. No.	Code	Course	Hours/week			Credits	Maximum Marks			ESE Duration (Hours)
			L	T	P		Continual Assessment	End Sem Examination	Total	
1.	PHT156	Semiconductor Physics	3	1	0	4	40	60	100	03
2.	PHP156	Semiconductor Physics Lab	0	0	3	1.5	25	25	50	--
3.	MAT152/ MAT151	Differential Equations, Linear Algebra, Statistics & Probability / Calculus	3	0/1	0	3/4	40	60	100	03
4.	MAP151	Computational Mathematics Lab	0	0	2	1	25	25	50	--
5.	EET151	Basic Electrical Engineering	3	1	0	4	40	60	100	03
6.	EEP151	Basic Electrical Engineering Lab	0	0	2	1	25	25	50	--
7.	MET151	Engineering Graphics & Design	1	0	0	1	40	60	100	03
8.	MEP151	Engineering Graphics & Design Lab	0	0	4	2	50	50	100	--
9.	HUT152	Constitution of India	2	0	0	0	--	--	--	--
10	PEP151	Yoga/Sports	0	0	2	0	--	--	--	--
		Total	12	2/3	13	17.5/18.5			650	

GROUP 1: SEMESTER-II/ GROUP 2: SEMESTER-I

Sr. No.	Code	Course	Hours/week			Credits	Maximum Marks			ESE Duration (Hours)
			L	T	P		Continual Assessment	End Sem Examination	Total	
1.	CHT152	Chemistry	3	1	0	4	40	60	100	03
2.	CHP152	Chemistry Lab	0	0	3	1.5	25	25	50	--
3.	MAT151/ MAT152	Calculus / Differential Equations, Linear Algebra, Statistics & Probability	3	1/0	0	4/3	40	60	100	03
4.	CST151	Programming for Problem Solving	4	0	0	4	40	60	100	03
5.	CSP151	Programming for Problem Solving Lab	0	0	2	1	25	25	50	--
6.	IDT151	Creativity, Innovation & Design Thinking	1	0	0	1	20	30	50	1.5
7.	INT151	Workshop/Manufacturing Practices	1	0	0	1	20	30	50	1.5
8.	INP151	Workshop/Manufacturing Practices Lab	0	0	2	1	25	25	50	--
9.	HUT151	English	2	0	0	2	40	60	100	03
10.	HUP151	English Lab	0	0	2	1	25	25	50	--
		Total	14	2/1	9	20.5/19.5			700	

Program Scheme and Syllabi for B. E. (Computer Science & Engineering)

Scheme of Teaching & Examination of Bachelor of Engineering (Computer Science Engineering); Semester : III

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
				L	T	P		Continuous evaluation	End Sem Exam	Total	
1	PCC	CST251	Fundamentals of Digital Logic and Computer Architecture	4	0	0	4	40	60	100	3 Hrs
2	PCC	CSP251	Fundamentals of Digital Logic and Computer Architecture Lab	0	0	2	1	25	25	50	-
3	PCC	CST252	Data Structures & Algorithms	3	0	0	3	40	60	100	3 Hrs
4	PCC	CSP252	Data Structures & Algorithms Lab	0	0	4	2	25	25	50	- -
5	PCC	CSP253	Systems Lab-I	0	0	4	2	25	25	50	- -
6	BSC	MAT252	Linear Algebra and Statistics	2	1	0	3	40	60	100	3 Hrs
7	HSSM	HUT253	Business Communication	3	0	0	3	40	60	100	3 Hrs
8	HSSM	HUT257	Cyber Laws & Ethics in IT	2	0	0	2	40	60	100	3 Hrs
	Total			**14**	**1**	**10**	**20**	**275**	**375**	**650**	

Scheme of Teaching & Examination of Bachelor of Engineering (Computer Science Engineering); Semester : IV

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
				L	T	P		Continuous evaluation	End Sem Exam	Total	
1	PCC	CST254	Discrete Mathematics and Graph Theory	4	0	0	4	40	60	100	3 Hrs
2	PCC	CST255	Operating Systems	3	0	0	3	40	60	100	3 Hrs
3	PCC	CSP255	Operating Systems Lab	0	0	4	2	25	25	50	-
4	PCC	CST256	Object Oriented Programming	3	0	0	3	40	60	100	3 Hrs
5	PCC	CSP256	Object Oriented Programming Lab	0	0	2	1	25	25	50	-
6	PCC	CST257	Formal Languages & Automata Theory	3	0	0	3	40	60	100	3 Hrs
7	PCC	CST258	System Programming & Device Drivers	3	0	0	3	40	60	100	3 Hrs
8	PCC	CSP258	System Programming & Device Drivers Lab	0	0	2	1	25	25	50	-
9	PCC	CSP259	Systems Lab-II	0	0	4	2	40	60	100	-
10	OEC	CST299	Open Elective-I	3	0	0	3	40	60	100	3 Hrs
11	MC	CHT252	Environmental Sciences	2	-	-	0	-	-	-	-
				20	**1**	**12**	**25**	**355**	**495**	**850**	-

Department of Computer Science and Engineering

Scheme of Teaching & Examination of Bachelor of Engineering (Computer Science Engineering); Semester : V

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
				L	T	P		Continuous evaluation	End Sem Exam	Total	
1	PCC	CST351	Database Management Systems	3	0	0	3	40	60	100	3 Hrs
2	PCC	CSP351	Database Management Systems Lab	0	0	4	2	25	25	50	-
3	PCC	CST352	Design & Analysis of Algorithms	3	1	0	4	40	60	100	3 Hrs
4	PCC	CSP352	Design & Analysis of Algorithms Lab	0	0	2	1	25	25	50	-
5	PCC	CST353	Computer Networks	3	0	0	3	40	60	100	3 Hrs
6	PCC	CSP353	Computer Networks Lab	0	0	2	1	25	25	50	-
7	PCC	CSP354	Mobile Prog. Lab	0	0	4	2	25	25	50	-
8	OEC	CST398	Open Elective-II	3	0	0	3	40	60	100	3 Hrs
9	PEC	CST355	Elective-I	3	0	0	3	40	60	100	3 Hrs
10	MC	HUT353	Indian Traditional Knowledge	2	-	-	0	-	-	-	-
				17	**1**	**12**	**22**	**300**	**400**	**700**	**-**

Course Code	ELECTIVE – I
CST355-1	Computer Graphics
CST355-2	Embedded Systems
CST355-3	Information Theory & Coding
CST355-4	Design Patterns

Scheme of Teaching & Examination of Bachelor of Engineering (Computer Science Engineering); Semester : VI

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
				L	T	P		Continuous evaluation	End Sem Exam	Total	
1	PCC	CST356	Artificial Intelligence	3	0	0	3	40	60	100	3 Hrs
2	PCC	CSP356	Artificial Intelligence Lab	0	0	2	1	25	25	50	-
3	PCC	CST357	Software Engineering	3	0	0	3	40	60	100	3 Hrs
4	PCC	CSP357	Software Engineering Lab	0	0	2	1	25	25	50	-
5	PCC	CST358	Complier Design	3	0	0	3	40	60	100	3 Hrs
6	PCC	CSP358	Complier Design Lab	0	0	4	2	25	25	50	-
7	PEC	CST359	Elective-II	3	0	0	3	40	60	100	3 Hrs
8	OEC	CST399	Open Elective-III	3	0	0	3	40	60	100	3 Hrs
9	PR	CSP360	Project-1	0	0	6	3	25	25	50	-
10	PCC	CSP361	Comprehensive Viva	0	0	2	1	25	25	50	-
				15	0	16	23	325	425	750	-

Course Code	ELECTIVE – II
CST359-1	Advanced Algorithms
CST359-2	Distributed Systems
CST359-3	Digital Signal Processing
CST359-4	Data Warehousing & Mining

Department of Computer Science and Engineering

Scheme of Teaching & Examination of Bachelor of Engineering (Computer Science Engineering); Semester : VII

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
				L	T	P		Continuous evaluation	End Sem Exam	Total	
1	PCC	CST451	Elective-III	3	0	0	3	40	60	100	3 Hrs
2	PCC	CSP451	Elective-III Lab	0	0	2	1	25	25	50	-
3	PCC	CST452	Elective-IV	3	0	0	3	40	60	100	3 Hrs
4	PCC	CSP452	Elective-IV Lab	0	0	2	1	25	25	50	-
5	OEC	CST498	Open Elective-IV	3	0	0	3	40	60	100	3 Hrs
6	BSC	IDT451	Bio-informatics	2	1	0	3	40	60	100	3 Hrs
7	PR	CSP454	Project-2	0	0	12	6	50	50	100	-
8	PR	CSP455	Industry Internship Evaluation	0	0	2	0	-	-	-	-
				11	**1**	**18**	**20**	**260**	**340**	**600**	-

Course Code	ELECTIVE - III	Course Code	ELECTIVE - IV
CST451-1	Machine Learning	CST452-1	Digital Image & Video Processing
CST451-2	Web Intelligence and Big Data	CST452-2	Distributed and Parallel Database
CST451-3	Data Visualization & Analytics	CST452-3	Game Theory
CST451-4	Fundamentals of Augmented Reality	CST452-4	Cloud Computing

Scheme of Teaching & Examination of Bachelor of Engineering (Computer Science Engineering); Semester : VIII

Sr. No.	Category	Course code	Course Name	Hours/week			Credits	Maximum marks			ESE duration (Hrs)
				L	T	P		Continuous evaluation	End Sem Exam	Total	
1	PEC	CST456	Elective-V	3	0	0	3	40	60	100	3 Hrs
2	PEC	CST457	Elective-VI	3	0	0	3	40	60	100	3 Hrs
3	PR	CSP458	Project-3/Industry Internship	0	0	12	6	50	50	100	-
				6	0	12	12	130	170	300	-

Course Code	ELECTIVE - V	Course Code	ELECTIVE - VI
CST456-1	Neural Network & Deep Learning	CST457-1	Information Retrieval
CST456-2	Robotics: Perception & Estimation	CST457-2	Natural Language Processing
CST456-3	Multi Agent Intelligent Systems	CST457-3	Data Warehousing for Business Intelligence
CST456-4	Cryptography & Network Security	CST457-4	Internet of Things

Course Code	Open Elective	Course Name
CST299-1	Open Elective - I	Java Programming and UI Design Concepts
CST299-2	Open Elective - I	Design Thinking for Innovation
CST398-1	Open Elective – II	Python and Data Analysis
CST399-1	Open Elective – III	Recent Trends in Computing
CST498-1	Open Elective - IV	Data Analytics for Business Applications

Total Credits (III to VIII Semester): 122

Department of Computer Science and Engineering
Honors & Minor Curriculum Design

Honors Scheme

Sr. No.	Semester	Course code	Course Name	Hours per Week	Credits	Maximum marks			ESE Duration in (Hrs)
						Continuous Evaluation	End Sem Exam	Total	
1	IV	CSTH41	Programming for Advanced Computing	4	4	40	60	100	3
2	V	CSTH51	Fundamentals of AWS Cloud / MOOC	4	4	40	60	100	3
3	VI	CSTH61	MERN Stack / MOOC	4	4	40	60	100	3
4	VII	CSTH71	MERN Stack - 1 / MOOC	4	4	40	60	100	3
5	VIII	CSTH81	Big Data Analysis / MOOC	4	4	40	60	100	3

Note

1. Student can opt for MOOC courses as per list provided by the Department at the start of session.
2. Selection, Completion, Examination process of MOOC course to be done during VIII sem duration only.

Minor Scheme

Sr. No.	Semester	Course code	Course Name	Hours per Week	Credits	Maximum marks			ESE Duration in (Hrs)
						Continuous Evaluation	End Sem Exam	Total	
1	IV	CSTM41	Data Structures & Algorithms	4	4	40	60	100	3
2	V	CSTM51	Software Engineering & Project Management	4	4	40	60	100	3
3	VI	CSTM61	AI and Machine Learning	4	4	40	60	100	3
4	VII	CSTM71	Mobile Application Programming	4	4	40	60	100	3
5	VIII	CSTM81	Database Management System	4	4	40	60	100	3

Note

1. If any of the subjects is offered by the parent department, then with the prior permission of HOD, CSE the student can opt for
   a. ONE/TWO Program Electives (for same/more credits) offered by CSE OR
   b. MOOC courses (for same/more credits)
2. Students cannot opt for an open elective course of any departments which are aligned with the courses offered in Minors.
3. Examination of Honors and Minor shall be conducted separately.

Syllabus for Semester I / II

(Electronics Engineering, Electronics and Communication Engineering, Computer Science Engineering, Information Technology, Computer Science Engineering (Data Science))

Course Code : PHT156 **Course : PHYSICS : Semiconductor Physics (Theory)**

Category : Basic Science Course

L: 3 Hrs. T: 1 Hrs. P: 0 Hrs. Per week **Total Credits : 4**

Course Objectives

1. To introduce ideas of quantum mechanics necessary to begin understanding semiconductor devices;
2. To familiarize prospective engineers with fundamental concepts of semiconductors and their interaction with light and resulting devices

Course Outcomes

After successful completion of the course students will

1. Have an elementary understanding of quantum behaviour of electrons in solids;
2. Have a grasp of band structure and its consequences for semiconductors;
3. Should be able to use band structure to explain effects of doping,on the properties of junctions between semiconductors and metals;
4. Have an elementary understanding of working of optoelectronic devices

Module 1: Quantum Mechanics Introduction

Wave-particle duality, Heisenberg uncertainty relations, the quantum state wave function and its probability interpretation, Schrodinger's equation, Energies and wave functions of a single electron in one-dimensional infinite potentials: formulae, function graphs, number of bound states, tunneling, One electron atom, periodic table, Quantum confinement effects in nanosystems

Module 2: Electronic Materials

Free electron theory, Extension of idea of energy level splitting in molecules to bonding in solids, Energy bands in solids, Kronig-Penny model (to better demonstrate origin of band gaps), Band gap based classification of electronic materials: metals, semiconductors, and insulators, E-k diagram, Direct and indirect bandgaps, Valence and conduction bands, Density of states, Fermi-Dirac statistics: Occupation probability of states, Fermi level, Effective mass.

Module 3: Intrinsic and Extrinsic Semiconductors

Intrinsic and extrinsic semiconductors, Dependence of Fermi level on carrier-concentration and temperature (equilibrium carrier statistics), Carrier transport: diffusion and drift

Module 4: Non-Equilibrium Semiconductors

Carrier generation and recombination, Continuity equation, Ambipolar transport equation, Quasi-Fermi Energy levels, Excess Carrier Lifetime, Qualitative introduction to recombination mechanisms, Shorkley - Read-Hall Recombination, Surface Recombination

Module 5: Junction Physics

p-n junction, Zero applied bias, forward bias, reverse bias, Metal-semiconductor junction, Shottky barrier, Ideal junction properties, Ohmic contacts, ideal non-rectifying barrier, tunneling barrier, Heterojunctions, Nanostructures, Energy band diagram, two dimensional electron gas

Module 6: Light - Semiconductors Interaction

Optical absorption in semiconductors, Light emitting diodes, Principles, Device Structures, Materials, High Intensity LEDs, Characteristics, LASERS, Stimulated emission and photon amplification, Einstein Coefficients, Laser oscillation conditions, Laser diode, Solar Energy Spectrum, photovoltaic device principles, Solar Cells

Text Book(s)

Modules 1-5

1. Semiconductor Physics and Devices (Fourth Edition), Donald A. Neamen, McGraw-Hill 2012.

Reference

1. Physics of Semiconductor Devices, S. M. Sze, 2nd Edition, Willey-Interscience Publication 1986

Modules 6

1. Online course: Semiconductor Optoelectronics by M. R. Shenoy on NPTEL
2. Optoelectronics and Photonics: Principles and Practices by S. O. Kasap, Prentice Hall 2001

Syllabus for Semester I / II

(Electronics Engineering, Electronics and Communication Engineering, Computer Science Engineering, Information Technology, Computer Science Engineering (Data Science))

Course Code : PHP156 **Course : Semiconductor Physics (Lab)**

Category : Basic Science Course

L: 0 Hrs. T: 0 Hrs. P: 3 Hrs. Per week **Total Credits : 1.5**

Course Outcomes

The Physics Lab course consists of experiments illustrating the principles of physics relevant to the study of science and engineering. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in physics and compare the results obtained with theoretical calculations.
3. Understand measurement technique, and report the results obtained through proper graph plotting and error analysis.

In addition to the General physics experiments, the Lab turns will be utilized for performing the experiments based on the following lists as specific to Program

General Physics

1. Error analysis and graph plotting
2. Newton's law of cooling
3. Simple Pendulum
4. Magnetic flux using deflection magnetometer
5. Dispersive power and determination of Cauchy's constants
6. Data analysis using Mathematica.
7. Cathode Ray Oscilloscope

Semiconductor Physics and Devices

1. Energy gap of semiconductor/thermister
2. Study of Hall Effect
3. Parameter extraction from I-V characteristics of a PN junction diode
4. Parameter extraction from I-V characteristics of a zener diode

5. Study of diode rectification
6. Parameter extraction from I-V characteristics of a transistor in common-emitter configuration.
7. V-I Characteristics of Light Emitting Diodes
8. Study of a photodiode
9. Solar Cell (Photovoltaic cell)
10. Resistivity measurement by Four Probe method

A minimum of 8 experiments to be performed from the following list of experiments

Syllabus for B.E. Semester I / II

Bachelor of Engineering

Course Code : MAT151 **Course : Calculus**

L: 3 Hrs., T: 1 Hrs., P: 0 Hrs., Per week **Total Credits : 04**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Calculus and multivariate analysis. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The fallouts of Mean Valve Theorems that is fundamental to application of analysis to Engineering problems, to deal with functions of several variables that are essential in most branches of engineering.
2. Basics of improper integrals, Beta and Gamma functions, Curve Tracing, tool of power series and Fourier series for learning advanced Engineering Mathematics.
3. Multivariable Integral Calculus and Vector Calculus and their applications to Engineering problems.

Syllabus

Module - I : Differential Calculus: (12hours)

Taylor's and Maclaurin's series expansions; radius of curvature (Cartesian form), evolutes and involutes, Limit and continuity of functions of several variables and their partial derivatives, Eulers Theorem, chain rule, total derivative, Jacobians, Maxima, minima and saddle points; Method of Lagrange multipliers.

Module - II : Integral Calculus: (6 hours)

Evaluation of definite and improper integrals; Beta and Gamma functions and their properties; Tracing of curves (Cartesian form)

Module - IV : Sequences and series: (7 hours)

Convergence of sequence and series, tests for convergence, power series, Fourier series: Half range sine and cosine series, Parseval's theorem.

Module - V : Multiple Integrals (10 hours)

Multiple Integration: Double and triple integrals (Cartesian and polar), change of order of integration in double integrals, Change of variables (Cartesian to polar), Applications: area, mass and volume by double integration, Center of mass and Gravity (basic concepts).

Module - VI : Vector Calculus (10 hours)

Vector Differentiation, Directional derivatives, total derivative, Gradient, Curl and Divergence. Vector integration , Theorems of Green, Gauss and Stokes and their applications.

Topics for self learning

Rolle's theorem, Mean value theorems, Indeterminate forms , Maxima and minima for function of one variable, Geometrical interpretation of Partial Differentiation(Tangent plane and Normal line) , Applications of definite integrals to evaluate perimeter, area, surface areas and volumes of revolutions.

Textbooks/References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. Veerarajan T., Engineering Mathematics for first year, Tata McGraw-Hill, New Delhi, 2008.
3. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
4. Ramana B.V., Higher Engineering Mathematics, Tata McGraw Hill New Delhi, 11th Reprint,2010.
5. P. N. Wartikar and J. N. Wartikar, A text book of Applied Mathematics Volume I & II, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).

Syllabus for B.E. Semester I / II

Course No. MAT152 **Course : Differential Equations, Linear Algebra, Statistics & Probability**

L: 3 Hrs., T: 0 Hrs., P: 0 Hrs., Per week **Total Credits : 03**

Course Objective

The objective of this course is to familiarize the prospective engineers with techniques in Ordinary differential equation, statistics, probability and Matrices.

It aims to equip the students to deal with advanced level of mathematics and applications that would be essential for their disciplines.

Course Outcomes

On successful completion of the course, the students will learn:

1. The effective mathematical tools for the solutions of ordinary differential equations that model physical processes.
2. The essential tool of matrices in a comprehensive manner.
3. The ideas of probability and various discrete and continuous probability distributions and the basic ideas of statistics including measures of central tendency, correlation and regression.

Syllabus

Module 1:First order ordinary differential equations(7 hours)

Exact, linear and Bernoulli's equations, Euler's equations, Equations not of first degree : equations solvable for p, equations solvable for y, equations solvable for x and Clairaut's type.

Module 2: Ordinary differential equations of higher orders (8 hours)

Second order linear differential equations with constant and variable coefficients, method of variation of parameters, Cauchy-Euler equation.

Module 3:Basic Statistics: (7 hours)

Curve fitting by the method of least squares- fitting of straight lines, second degree parabolas and more general curves, correlation and regression – Rank correlation, Multiple regression and correlation.

Module 4: Basic Probability: (8 hours)

Probability spaces, conditional probability, independence; Discrete random variables, Binomial distribution, Poisson distribution, Normal distribution. Relation between binomial, Poisson and Normal distributions.

Module 5: Matrices (10 hours)

Algebra of matrices, Inverse and rank of a matrix, rank-nullity theorem; System of linear equations; Symmetric, skew-symmetric and orthogonal matrices; Eigen values and eigenvectors; Diagonalization of matrices; Cayley-Hamilton Theorem, Orthogonal transformation and quadratic to canonical forms.

Topics for Self Learning

Application of Differential Equations.

Textbooks/References

1. Erwin Kreyszig, Advanced Engineering Mathematics, 9th Edition, John Wiley & Sons, 2006.
2. W. E. Boyce and R. C. DiPrima, Elementary Differential Equations and Boundary Value Problems, 9th Edition, Wiley India, 2009.
3. S. L. Ross, Differential Equations, 3rd Ed., Wiley India, 1984.
4. E. A. Coddington, An Introduction to Ordinary Differential Equations, Prentice Hall India, 1995.
5. E. L. Ince, Ordinary Differential Equations, Dover Publications, 1958.
6. B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 35th Edition, 2000.
7. Theory and Problems of probability and statistics : 2nded :J. R. Spiegal ,Schaum series
8. A text book of Applied Mathematics Volume I & II, by P. N. Wartikar and J. N. Wartikar, Pune Vidhyarthi Griha Prakashan, Pune-411030 (India).
9. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

Syllabus of Mathematics Computational Lab for Semester I/II, B.E. (2018-19)

Course Code : MAP151 **Course : Computational Mathematics Lab**

L:0 Hr., T:0Hrs., P:2 Hrs., Per week **Total Credits : 1**

Course Outcomes

The Computational Mathematics Lab course will consist of experiments demonstrating the principles of mathematics relevant to the study of science and engineering. Students will show that they have learnt laboratory skills that will enable them to properly acquire and analyze the data in the lab and draw valid conclusions. At the end of the Course the students will learn to:

1. Develop skills to impart practical knowledge in real time.
2. Understand principle, concept, working and application of areas in mathematics and compare the results obtained with theoretical calculations.
3. Understand basics of mathematics, and report the results obtained through proper programming.

The Lab turns will be utilized for performing the experiments based on the following list:

1. Calculus
2. Ordinary Differential Equations
3. Statistics
4. Linear Algebra

Suggested References

1. Computational Mathematics Lab Manual written by the Teaching Faculty of Mathematics Department, RCOEM.

A minimum of 8 experiments to be performed based on the above list.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code : EET151 Course : Basic Electrical Engineering

Course Outcomes

At the end of this course, students will demonstrate the ability

CO1: Understand and analyze basic ac and dc electric circuits and magnetic circuits

CO2: Understand working principles of electrical machines: Transformer, Induction motor, DC machines

CO3: Apply the knowledge of power converter for suitable applications

CO4: Introduce and identify the components of power systems and low-voltage electrical Installations.

Module 1: Introduction to Power system (2 hours)– CO4:

Introduction to Power Generation (Thermal, Hydro, Nuclear, Wind, and Solar) with block schematic presentation only. Single line diagram for Generation, Transmission & Distribution through different voltage levels.

Module 2 : DC Circuits & Magnetic Circuits(8 hours) - CO1:

Electrical circuit elements (R, L and C), voltage and current sources, Kirchoff's current and voltage laws, analysis of simple circuits with dc excitation, Time-domain analysis of first order RL and RC circuits, Magnetic materials, BH characteristics, Basics of Magnetic circuits.

Module 3: Single Phase AC Circuits (6 hours) - CO1:

Representation of sinusoidal waveforms, peak and rms values, phasor representation, real power, reactive power, apparent power, power factor. Analysis of single-phase ac circuits consisting of R, L, C, RL, RC, RLC combinations (series and parallel), resonance.

Module 4: Three Phase AC Circuits (4 hours) - CO1:

Three phase Ac generation, Three phase balanced circuits, voltage, and current relations in star and delta connections. Power factor improvement.

Module 5: Transformers (6 hours) - CO2:

Ideal and practical transformer, Equivalent circuit, losses in transformers, regulation, and efficiency. Auto transformer and three-phase transformer connections.

Module 6: Electrical Machines (8 hours) - CO2:

Generation of rotating magnetic fields, Construction and working of a three-phase induction motor, Significance of torque-slip characteristic. Loss components, efficiency, starting of induction motor. Single- phase induction motor. Construction, working, torque-speed characteristic, and speed control of separately excited dc motor.

Module 7: Power Converters (4 hours) - CO3:

Block schematic introduction to power converters and its practical applications (DC-DC, DC-AC, AC-DC, AC- AC), Types of Batteries, Important Characteristics for Batteries and battery backup.

Module 8: Electrical Installations (4 hours) - CO4:

Components of LT Switchgear: Switch Fuse Unit (SFU), MCB, ELCB, MCCB, Types of Wires and Cables, Earthing. Elementary calculations for energy consumption, energy tariff.

Text / References

1. D. P. Kothari and I. J. Nagrath, “Basic Electrical Engineering”, Tata McGraw Hill, 2010.
2. D. C. Kulshreshtha, “Basic Electrical Engineering”, McGraw Hill, 2009.
3. L. S. Bobrow, “Fundamentals of Electrical Engineering”, Oxford University Press, 2011.
4. E. Hughes, “Electrical and Electronics Technology”, Pearson, 2010.
5. V. D. Toro, “Electrical Engineering Fundamentals”, Prentice Hall India, 1989.
6. Electrical Technology: B. L. Thereja, S. Chand Publications.
7. Basic Electrical Engineering: S. B. Bodkhe, N. M. Deshkar, P. P. H. Pvt. Ltd.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code : EEP151 **Course: Basic Electrical Engineering Lab.**

Course Outcomes

Upon completion of this course, the students shall be able to,

CO1: Co-relate, analyze and apply the fundamental principles of science and engineering to understand the laboratory experimental work.

CO2: Connect the electric circuit, perform the experiment, analyze the observed data and make valid conclusion.

CO3: Write report based on the performed experiments (journal) with effective presentation of diagrams and characteristics/graphs.

CO4: Carry out survey of electrical energy consumption at home and calculate monthly energy bill as per the tariff of power Distribution Company.

List of Experiments

1. To verify Kirchhoff's laws for D.C. Circuits
2. Verification of Kirchhoff's laws to AC circuit(RLC series)
3. Verification of Kirchhoff's laws to AC circuit (RLC parallel).
4. To study speed control of D.C. shunts motor by:
   a) Armature voltage Control method.
   b) Field current/flux control method.
5. To study the balanced Three phase system for star and delta connected balanced load.
6. Improvement of power factor by using static capacitors
7. To determine regulation and efficiency of a single phase transformer by open circuit (o.c) and short circuit (s.c.) tests.
8. To determine regulation and efficiency of a single phase transformer by direct loading test

Demonstration/ Study experiment

9. To study B-H curve for different magnetic material
10. To study Buck converter
11. To study Boost converter

Demonstration of cut out sections of machines:

i. DC Machine
ii. Three phase squirrel cage induction motor
iii. Synchronous machine

Syllabus of Department of Mechanical Engineering

Course Code : MET151 **Course: Engineering Graphics and Design**

L:1 Hr., T:0Hrs., P:0 Hrs., Per week **Total Credits : 01**

Course Outcomes

The expected learning outcome is that, the students shall be able to

1. Draw and interpret technical drawing
2. Convert 2-D to 3-D drawing and vice versa.
3. Represent the various positions of planes and solids in different orientations.
4 Develop the solid surface for sheet metal working.

UNIT 1 : Introduction to Engineering Drawing

Principles of Engineering Graphics and their significance, usage of drawing instruments, Lettering and dimensioning.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections -Conventions : Projections of Points and lines (line inclined to both planes) Projections of planes (inclined to both the planes), Introduction to Auxiliary Planes;

UNIT 3 : Projections of Solids

Inclined to both the Planes - Auxiliary Views; Draw simple annotation, dimensioning and scale. Floor plans that include : windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism, Cylinder, Pyramid Cone-Auxiliary Views; Development of surface of Right Regular solids - Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only)

UNIT 5 : Isometric Projections

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; Conversion of Orthographic views to Isometric Views / Projection.

Suggested Text / Reference Books

i) Bhatt N. D. Panchal V.M. & Ingle P.R., (2014) Engineering Drawing, Charotar Publishing House.

ii) Jolhe D. A. (2016) Engineering Drawing with an Introduction to Auto CAD", Tata McGraw- Hill Publishing Co. Ltd., New Delhi.

iii) Narayana K. L. & P. Kannaiah (2008), Text book on Engineering Drawing, Scitech Publishers.

iv) Shah M. B. & Rana B. C. (2008), Engineering Drawing and Computer Graphics, Pearson Education.

v) Agrawal B & Agrawal C. M. (2012), Engineering Graphic, TMH Publication.

vi) Corresponding set of CAD Software Theory and User Manuals.

Syllabus of Department of Mechanical Engineering

Course Code : MEP151 **Course : Engineering Graphics & Design Lab**

L:0 Hr., T:0Hrs., P:4 Hrs., Per week **Total Credits : 02**

Course Outcomes

Students are prepared for actual work situations through practical training in a new state of the art computer designed CAD laboratory using engineering software. The student will learn to :

1. Draw and interpret technical drawing
2. Plan the sheet layout for the given drawing
3. Convert 2-D to 3-D drawing and vice versa
4. Represent the various positions of planes and solids in different orientations.
5. Develop the solid surface for sheet metal working
6. Use & demonstrate drafting package.

UNIT 1 : Introduction to Engineering Drawing

Conic sections including the Rectangular Hyperbola (General method only); Cycloid, Epicycloids, Hypocycloid and involutes; Introduction to Scales.

UNIT 2 : Orthographic Projections

Principles of Orthographic Projections -Conventions - Projections of Points and lines inclined to both planes; Projections of planes - Auxiliary Planes.

UNIT 3 : Projections of Solids

Inclined to both the Planes Auxiliary Views; Draw simple annotation, dimensioning and scale, Floor plans that include: windows, doors, and fixtures such as WC, bath, sink, shower, etc.

UNIT 4 : Sections and Sectional Views of Right Angular Solids

Prism Cylinder, Pyramid, Cone - Auxilary Views; Development of surfaces of Right Regular Solids Prism, Pyramid, Cylinder and Cone; Draw the sectional orthographic views of geometrical solids, objects from industry and dwellings (foundation to slab only).

UNIT 5 : Isometric Projections

Principles of Isometric projection - Isometric Scale, Isometric Views, Conventions; Isometric Views of Simple Solids; conversion of Orthographic views to Isometric views / Projection.

UNIT 6 : Overview of Computer Graphics

Demonstrating knowledge of the theory of CAD software such as (the Menu System Toolbars Standard, Object Properties, Draw, Modify and Dimension), Drawing Area (Background, crosshairs, Coordinate Systems), Dialog boxes and windows, Shortcut menus (Button Bars), The command Line (wherever applicable), The Status Bar, Different methods of zoom as used in CAD, select and erase objects; Isometric Views of lines, Planes, Simple and compound solids).

UNIT 7 : Customization & CAD Drawing

Setting up drawing page and the printer, including scale settings, Setting up of units and Drawing limits; ISO and ANSI standards for coordinate dimensioning; Orthographic constraints, map toobjects, manually and automatically, Producing drawings by using various coordinate input entry methods to draw straight lines, Applying various ways of drawing circles.

UNIT 8 : Annotations Layering & Other Functions

Applying dimensions to objects, applying annotations to drawings; Changing line lengths through modifying existing lines (extend/lengthen); Printing documents to paper using the print command; orthographic projection techniques.

UNIT 9 : Demonstration of a simple team design project that illustrates

Geometry and Topology of Engineered Components Creation of Engineering models and their presentation in standard 2D blueprint form and as 3D wire-frame and shaded solids; Meshed toplogies for engineering, Introduction to Building Information Modeling (BIM), Drafting and Design Package, 3D Printing.

List of sheets

1. Curves (ellipse, Parabola, hyperbola, Cycloid, involute)
2. Line, Planes, Solids
3. Application of Section and development of solids
4. Orthgraphic Projection
5. Isometric
6. Auto CAD practice sheet 1
7. Auto CAD practice sheet 2
8. Blueprint sheet

Suggested Text/ Reference Books

1. Bhatt N.D. Panchal V.M. & Ingle P.R., (2014), Engineering drawing, Charotar Publiishing house
2. Jolhe D.A., (2016) Engineering drawing with an Introduction to Auto CAD", Tata McGraw-Hill Publishing Co. Ltd., New Delhi.
3. Shah M.B. & Rana B.C. (2008), Engineering drawing and Computer Graphic, Pearson Education.
4. Agarwal B & Agarwal C.M. (2012), Engineering Graphics, TMH PUBLICATION
5. Narayana K.L & P Kannaiah (2008), Text Book on Engineering Drawing, Scitech Publishers.
6. (Concesponding set of) CAD Software Theory and USER Manuals.

Syllabus for B.E. Semester I Department of Humanities

Course Code : HUT152 **Course : Constitution of India**

L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 0**

Course outcome

1. Students will understand the role of constitution in democratic India
2. Students will be responsible students by knowing their fundamental rights and duties
3. Students will develop better understanding of democratic functions of the government of India
4. Students will form better understanding of system of governance for effective participation

Course content

1. Meaning of the constitution law and constitutionalism
2. Historical perspective of the Constitution of India
3. Salient features and characteristics of the Constitution of India
4. Scheme of the Fundamental Rights
5. The scheme of the Fundamental Duties and its legal status
6. The Directive Principles of State Policy – Its importance and implementation
7. Federal structure and distribution of legislative and financial powers between the Union and the States
8. Parliamentary Form of Government in India – The constitution powers and status of the President of India
9. Union Executive: structure, functions
10. Judiciary: Structure, role with special reference to PIL, writ petitions, strengthening of democracy & social justice
11. Amendment of the Constitutional Powers and Procedure
12. Emergency Provisions: National Emergency, President Rule, Financial Emergency
13. Local Self Government – Constitutional Scheme in India
14. Provisions of civil services: Characteristics, functions, merits and demerits
15. Democratic principles in industry

Book

Durga Das Basu “An Introduction to Constitution of India” 22nd Edition, LexisNexis

Syllabus for B.E. Semester I Department of Humanities

Course Code : PEP151 **Course : Yoga / Sports**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits : 0**

Course outcome

On successful completion of the course, students will be able to:

1. Understand fundamental skills and basic rules of games offered by the Physical Education Department of RCOEM.
2. Obtained health related physical fitness.
3. Develop body-mind co-ordination through games and yoga.
4. Changed sedentary life styles towards active living.

Brief Objectives of Sports/Yoga Practical Classes

It has long been proven that a healthy body leads to a healthy mind. With a strong belief in this, Physical Education Department at RCOEM will conduct Sports/Yoga Classes with the objective of maintaining health, fitness and wellness of students as well as create awareness about need for good health and physical fitness. The objective would also be to make the all-round development with team spirit, social values as well as to identify and develop leadership qualities in students through various sports activities. Sports activities would also be conducted with the objective to provide better interaction and recreation to the students which is an important neutralizer for stress. Additionally, the objective would be to evaluate the health related fitness of students so as to recommend and conduct specific Yoga and Sports activities. The emphasis is on participation, with healthy competition.

Programme Outline

- **Sports :**

1. Introduction to sports, offered by the department.
2. Health and safety issues related to sports; knowledge, recognition and ability to deal with injuries and illness associated with sports.
3. Practicing the fundamental skills and bringing awareness of basic rules and regulations.
4. Conduction of small recreational games and activities.

- **Yoga :** Includes various sitting, standing and lying Asanas, Suryanamaskars and Pranayamas.
- Physical Efficiency Tests : This includes 6 health related physical fitness tests.

Components	Name of Tests
Speed	50 mts Dash
Agility	Shuttle run
Cardiovascular Endurance	8 mins Run/Walk
Test Flexibility	Sit and Reach Test
Abdominal Strength (M) / shoulder strength (F)	Bent Knee Sit-ups (M)/ Modified Pull-ups (F)
Yogic exercises	Suryanamaskars

Syllabus for B.E. Semester I / II

Course Code : CHT152 **Course : Chemistry**

L: 3 Hrs, T: 1 Hr, P : 0 Hr., Per week **Total Credits : 4**

Course Outcomes

After the successful completion of the course, students shall be able to

- Predict the properties and interactions of chemical substances by understanding their composition at the atomic level. **[CO for Unit – 1]**
- Conversant in applying unique properties of nano-materials to solve challenges in our life. **[CO for Unit – 2]**
- Explain the differences in the mechanical behavior of engineering materials based upon bond type, structure, composition, and processing. **[CO for Unit – 3]**
- Study chemical kinetics using concepts of computational chemistry. **[CO for Unit – 4]**
- Discuss how spectroscopic methods are used for qualitative and quantitative analyses. **[CO for Unit – 5]**
- Analyse impurities present in the water and suggest the methodology for its removal. **[CO for Unit – 6]**

Syllabus

Unit 1: Solid State Chemistry (7 Hours)

Bondings in atoms : Primary bonding: ionic, covalent, metallic. Secondary bonding: dipole-dipole, induced dipole-induced dipole, London dispersion/van der Waals, hydrogen. Shapes of molecules: hybridization, LCAO-MO, VSEPR theory.

Electronic material : Band theory: metals, insulators, and semiconductors. Band gaps, doping. Silicon wafer production.

Unit 2: Nano-material-I (7 Hours)

Basics of Nano chemistry : Definition of Nano, Scientific revolution-Atomic Structure and atomic size, emergence and challenges of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), One dimensional, Two dimensional and Three dimensional nanostructured materials, mechanical-physical-chemical properties.

Application of Nanomaterial : Molecular electronics and nano electronics, Nanotechnology for waste reduction and improved energy efficiency, Carbon Nanotubes for energy storage, Hydrogen Storage in Carbon Nanotubes, nanotechnology based water treatment strategies.

Unit 3: Advanced Materials: (7 hours)

Composite materials : Introduction, Classification: Polymer Matrix Composites, Metal Matrix Composites, Ceramic Matrix Composites, Carbon–Carbon Composites, Fiber - Reinforced Composites and Applications.

Reinforcements : Fibres- Glass, Kevlar, Carbon, Silicon Carbide, and Born Carbide Fibres.

Industrial Polymer : Thermoplastics, Thermosetting Plastics, Polymers used in electronic industries, Piezo and pyroelectric polymers, Polymers in optical media data storage devices.

Unit 4: Computational Chemistry [6 Hours]

Rate of the reaction, Order and Molecularity of the reaction, Rate expression for Zero Order, First Order and Second Order Reactions, Effect of the temperature, Use of Mathematica for determining rate of the reaction, etc.

Unit 5: Material Characterization using different Spectroscopic Techniques [7 Hours]

Fundamentals of spectroscopy, Infrared Spectroscopy, Electronic Spectrocopy, Nuclear Magnetic Resonance Spectroscopy.

Fundamentals of X-Ray Diffractions (XRD), X-Ray Fluorescence (XRF) spectroscopy.

Unit 6: Water Technology [8 Hours]

Impurities in natural water, hardness and alkalinity, Disadvantages of hardness i. e. sludge and scale formation, softening of water using lime-soda, zeolite and ion-exchange method, advantages and limitations of these water softening processes, Desalination of water using Reverse Osmosis.

Text Books

1. J. Michael Hollas, Modern Spectroscopy, Fourth Edition, John Wiley and Sons, 2004.
2. William Kemp, Organic Spectroscopy, Third Edition, Palgrave Publication, 1991.
3. Bradley D. Fahlman, Materials Chemistry, Third Edition, Springer Nature, 2018.
4. Brian W. Pfennig, Principles of Inorganic Chemistry, John Wiley and Sons, 2015.
5. Steven S. Zumdahl, Donald J. DeCoste, Chemical Principles, Eighth Edition, Cengage Learning, 2017.
6. Catherine E. Housecroft and Edwin C. Constable, Chemistry: An Introduction to Organic, Inorganic and Physical Chemistry, Third Edition, Pearson Education Limited, 2006.
7. Michael J. Moran and Howard N. Shapiro, Fundamentals of Engineering Thermodynamics, Fifth Edition, John Wiley and Sons, 2006.
8. Donald L. Pavia, Gary M. Lampman, George S. Kriz, and James R. Vyvyan, Introduction to Spectroscopy, Fifth Edition, Cengage Learning, 2009.
9. C. N. R. Rao, A. Muller and A. K. Cheetham, The Chemistry of Nanomaterials: Synthesis, Properties and Applications, Wiley-VCH, 2004.
10. P. C. Jain and Monica Jain, Engineering Chemistry, DhanpatRai Publication.
11. S. S. Dara, A Textbook of Engineering Chemistry, S. Chand Publications.
12. J. D. Lee, Concise Inorganic Chemistry, Fourth Edition, Chapman and Hall Publications.

Syllabus for B.E. Semester I / II

Course Code : CHP152 **Course : Chemistry Lab**

L: 0 Hrs., T: 0 Hrs., P: 3 Hrs., Per week **Total Credits : 1.5**

Course Outcomes

The chemistry laboratory course will consist of experiments illustrating the principles of chemistry relevant to the study of science and engineering.

The students will learn to:

- Estimate the amount of different impurities in water/waste water samples.
- Estimate rate constants of reactions and order of the reaction from concentration of reactants/products as a function of time and to validate adsorption isotherms.
- Measure molecular/system properties such as surface tension, viscosity of aqueous or other industrially important liquids/mixtures etc.
- Synthesize a polymer or drug molecule or nano-material.
- Use principle of spectroscopic techniques for structural determination.

List of Experiments: [Any Eight from the List]

[1] Preparation of different Solutions: Molar solution, Normal solution and percent solution and Determination of concentration.

[2] To find out types of alkalinity and estimation of their extent in the water sample.

[3] Estimation of temporary, permanent and total hardness present in the water sample using complexometric titration method.

[4] Spectroscopic/Colorimetric determine of wavelength of maximum absorption of chemical/biological compound in solution and determination of concentration using Lambert-Beer's Law.

[5] Determination of rate of the reaction of hydrolysis of ethyl acetate at room temperature and analysis of experimental data using Computational Software.

[6] To study chemical kinetics of peroxydisulphate and iodide ions reactions and to find out order of the reaction and analysis of experimental data using Computational Software.

[7] Synthesis of Nano-material/Polymer and its study.

[8] Determination of relative and kinematic viscosities of aqueous solutions of Poly-ethylene glycol (Polymeric Liquid) using Redwood Viscometer (type I or II) at different temperatures.

[9] To study effect of bondings of water molecules with electrolyte (NaCl/KCl) and non-electrolyte solute (Soap) in the solution through Surface Tension Determination.

[10] Study of ion-exchange column for removal of hardness in the water sample.

[11] Demonstrations of organic spectral techniques: IR, NMR.

[12] Demonstration of in-organic spectral techniques: XRD, XRF.

Text Books/Reference Books

(1) S. S. Dara, A Textbook on Experiments and Calculations in Engineering Chemistry, S. Chand Publications.

(2) J. B. Yadav, Advanced Practical Physical Chemistry, Krishna's Prakashan Media (P) Limited.

(3) A. J. Elias, Collection of Interesting General Chemistry Experiments, Universities Press Publications.

(4) V. K. Ahluwalia, S. Dhingra and A. Gulati, College Practical Chemistry, Universities Press Publications.

(5) Ashutosh Kar, Advanced Practical Medicinal Chemistry, New Age International Publisher.

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code: CST151 Course : Programming for Problem Solving

L: 4 Hrs.,T: 0 Hrs.,P: 0 Hrs.,Per week Total Credits : 4

Course Outcomes

On successful completion of course student will be able to:

1. Develop C programs from the algorithm for simple arithmetic and logical problems.
2. Design programs using conditional branching, iteration and recursion.
3. Formulate algorithm/programs using arrays, pointers, structures and I/O operations.
4. Design programs using matrix manipulation along searching & sorting problems.

UNIT-I: Introduction to Programming

Introduction to components of a computer system (disks, memory, processor, where a program is stored and executed, operating system, compilers etc.)

Idea of Algorithm : Steps to solve logical and numerical problems. Representation of Algorithm: Flowchart / Pseudocode with examples. Arithmetic expressions and precedence

UNIT-II: C Programming Language

Introduction to C language: Keywords, Constant, Variable, Data types, Operators, Types of Statements, Preprocessor Directives, Decision Control Statement-if, if-else, Nested if-else statement, Switch case, Loops and Writing and evaluation of conditionals and consequent branching.

UNIT-III: Arrays and Basic Algorithms

Arrays: 1-D, 2-D, Character arrays and Strings.

Searching, Basic Sorting Algorithms (Bubble, Insertion and Selection), Finding roots of equations, notion of order of complexity through example programs (no formal definition required)

UNIT-IV: Functions and Recursion

User defined and Library Functions, Parameter passing in functions, call by value, Passing arrays to functions: idea of call by reference. Recursion: As a different way of solving problems. Example programs, such as Finding Factorial, Fibonacci series, Ackerman function etc. Quick sort or Merge sort.

UNIT-V: Pointers and Structures

Structures, Defining structures, Array of Structures, Introduction to pointers, Defining pointers, Pointer arithmetic, pointer operators, Use of Pointers in self-referential structures, notion of linked list (no implementation) UNIT-VI: File handling

Streams in C, Types of Files, File Input/ Output Operations: Modes of file opening, Reading and writing the file, Closing the files, using fflush().

Text Books

1. Programming in ANSI C : E. Balguruswami McGraw Hill
2. Mastering C: K. R. Venugopal and S. R. Prasad, Tata McGraw Hill

Reference Books

1. Programming with C: Byron Gottfried, Schaums Outline Series.

Let Us C: Yashwant Kanetkar, BPB Publication

Syllabus of Group 1 - Semester I and Group 2 - Semester II, Bachelor of Engineering

Course Code: CSP151 Course : Programming for Problem Solving Lab

L: 0 Hrs.,T:0 Hrs.,P:2 Hrs.,Per week Total Credits : 1

Course Outcomes

On successful completion of course student will be able to:

1. Create C programs using loops and decision making statements to solve and execute the given problem.
2. Develop programs and functions one dimensional and two dimensional arrays.
3. Apply the concept of pointers, structures to develop programs.
4. Implement files in C to store the data for the given problem.

Experiment List

1. To Study Unix / Linux Operating System Environment and demonstrate basic data types in C and implementing arithmetic expressions.
2. To Study and Demonstrate Decision Control Structure.
3. To Study and Demonstrate Loop Control Structures.
4. To Study and Demonstrate Multi-way Decision Control Structures (Switch Case).
5. To Study and Demonstrate 1D and 2D Array.
6. To Study and Demonstrate Function and Recursion.
7. To Study and Demonstrate Structure and Pointers.
8. To Study and Demonstrate File Handling in C.

CREATIVITY INNOVATION AND DESIGN THINKING COURSE SYLLABUS

Course Code : IDT151 **Credits : 1**

L:1Hrs., T:0Hrs., P:0Hrs., Per week

Course Outcomes

C1: Be familiar with processes and methods of creative problem solving

C2: Enhance their creative and innovative thinking skills

C3: Practice thinking creatively and innovative design and development

Detailed Topics

UNIT I. Introduction: Making a case for creativity, Creative thinking as a skill, Valuing diversity in thinking: Thinking preferences, Creativity styles, Creativity in problem solving

UNIT 2. Pattern Breaking: Thinking differently , Lateral thinking, Mind stimulation: games, brain-twisters and puzzles, Idea-collection processes, Brainstorming/Brainwriting, The SCAMPER methods, Metaphoric thinking, Outrageous thinking , Mapping thoughts, Other (new approaches)

UNIT 3. Using Math and Science, Systematic logical thinking, Using math concepts, Eight-Dimensional (8D) Approach to Ideation: Uniqueness, Dimensionality, Directionality, Consolidation, Segmentation, Modification, Similarity, Experimentation

UNIT4. Systematic Inventive Thinking: Systematic inventive thinking: The TRIZ methodology, Decision and Evaluation: Focused thinking framework, Six thinking hats , Ethical considerations

UNIT 5. Design for Innovation: Introduction to design for interaction, nine lessons for innovation, difference in creativity and innovation, Building blocks for innovation

UNIT 6.Intellectual Property: Introduction to intellectual property: Patents, Copyrights©, Trademarks ®, Trade Secret, Unfair Competition.

Reference Books and Text Book

1. Creative Problem Solving for Managers - Tony Proctor - Routledge Taylor & Francis Group
2. 101 Activities for Teaching creativity and Problem Solving - By Arthur B Vangundy - Pfeiffer
3. H. S. Fogler and S.E. LeBlanc, Strategies for Creative Problem Solving, Prentice Hall
4. E. Lumsdaine and M. Lumsdaine, Creative Problem Solving, McGraw Hill,
5. J. Goldenberg and D. Mazursky, Creativity in product innovation. Cambridge University Press, 2002.

Course Assignments for internal continuous assessment of 20 Marks (NO T1 and T2)

- Brain teasers (aka Puzzle Busters, to be solved individually)
- Cartoon captions (small teams)
- TRIZ, a systematic ideation method, reading (individual)
- Book readings and discussions (small teams)
- Small teams presentations on innovation: (1) innovative individual, (2) innovative company, (3) innovative movie / game, (4) sustainable innovation, (5) innovation in business, (6) innovation in art, (7) innovation in architecture, (8) innovative nation, (9) innovation in science, and (10) innovation in engineering.
- Large groups hands-on projects
- Eight-dimensional (8D) ideation method examples
- Large teams videos

Syllabus Department of Industrial Engineering

Course Code : INT151 **Course : Workshop / Manufacturing Practices (Theory)**

L:1Hrs., T:0Hrs., P:0Hrs., Per week **Total Credits:1**

Course Outcomes

1. Identify the different manufacturing process commonly employed in Industry along with prevailing safety practices.
2. Identify the various tools and equipments to carry out different manufacturing processes accompanied by the inspection of the work part.

Syllabus

Unit-1 Fundamentals of metal cutting, single point cutting tool, fundamental mechanics of metal cutting, fitting operations, and associated measuring and marking tools

Unit-2 Introduction to pattern making for metal casting, different types of carpentry tools, measuring tools and marking tools, holding devices, different types of carpentry joints.

Unit-3 Smithy and Forging, Forging tools like chisels, hammers, types of furnaces, types of coal, Forming operations, Hot working and Cold working of metals.

Unit-4 Metal joining Process, mechanics of welding, types of welding, soldering and brazing, types of joints

Unit-5 Introduction to foundries, Metal Casting, types of sand, Introduction to Molding tools & casting process.

Unit-6 Introduction to Plastic Injection Molding

Suggested Text Book

1. "Elements of Workshop Technology" Hajra S.K, Choudhury A. K , Roy Nirjhar Vol. I and Vol .II, Media Promoters and Publishers Private Ltd. Mumbai.

Reference Books

1. Kalpakjian S. and Schmid S. “Manufacturing Engineering and Technology”4th Edition, Pearson India Education 2008
2. Roy A. and Lindberg, “Process and Materials of Manufacture”4th Edition, Prentice Hall India 1998.

Syllabus Department of Industrial Engineering

Course Code : INP151 **Course : Workshop/Manufacturing Practices Lab (Practical)**

L:0Hrs.,T:0Hrs.,P:2Hrs.,Per week **Total Credits :1**

Laboratory Outcomes

On the completion of the course the students shall be able to;

1. Recognize the different manufacturing process commonly employed in the Industry
2. Make the components using required manufacturing process, inspection methods while practicing the requisite safety precautions

Contents

1. Fitting Practice
2. Welding and Soldering Practice
3. Pattern Making Practice
4. Metal Casting Practice
5. Smithy and Forging Practice
6. Machining Practice
7. Plastic Molding Process
8. Glass Cutting Process

Suggested Text Book

1. “Elements of Workshop Technology'” Hajra S.K, Choudhury A.K , Roy Nirjhar Vol. I and Vol .II, Media Promoters and Publishers Private Ltd Mumbai.

Reference Books

1. Kalpak Jain S. and Schmid S. “Manufacturing Engineering and Technology”4th Edition, Pearson India Education 2008
2. Roy A. and Lindberg, “Process and Materials of Manufacture", Prentice hall India 1998.

Syllabus for B.E. Semester I / II Dept of Humanities Humanities and Social Sciences

Course Code: HUT151 **Course : English**

L: 2 Hrs. T: 0 Hrs. P: 0 Hrs. Per week **Total Credits : 2**

Course Objectives

The main objective of the subject is to enhance the employability skills of engineering students as well as communication skills at work place. The sub-objectives are:

1. To develop vocabulary of students.
2. To orient students in basic writing skills.
3. To orient students in functional grammar.
4. To orient students in the process of effective writing.
5. To provide practice and improve students' oral communication skills.

Course Outcomes

1. Students will have good word power.
2. Students will acquire basic writing skills.
3. Students will understand functional grammar and its usage.
4. Students will organize and express their thoughts effectively through written communication.
5. Students will learn oral communication skills in order to handle themselves effectively in an interview and group discussion

SYLLABUS

1. Vocabulary Building

1.1. The concept of Word Formation

1.2. Root words from foreign languages and their use in English

1.3. Acquaintance with prefixes and suffixes from foreign languages in English to form derivatives

1.4. Synonyms, Antonyms and standard abbreviations

2. Basic Writing Skills

2.1 Sentence Structures

2.2 Use of phrases and clauses in sentences

2.3 Importance of proper punctuation

2.4 Creating coherence

2.5 Organizing principles of paragraphs in documents

2.6 Techniques for writing precisely

3. Identifying Common Errors in Writing

3.1 Subject-verb agreement

3.2 Noun-pronoun agreement

3.3 Misplaced modifiers

3.4 Articles

3.5 Redundancies

Cliches

1. Nature and Style of sensible Writing

4.1 Describing

4.2 Defining

4.3 Classifying

4.4 Providing examples or evidence

2. Writing Practices

5.1 Comprehension

5.2 Precis Writing

5.3 Essay Writing

5.4 Letter Writing

5.5 Email Writing

3. Oral Communication

(This unit involves interactive practice sessions in Language Lab)

- Listening Comprehension
- Pronunciation, Intonation, Stress and Rhythm
- Common Everyday Situations : Conversations and Dialogues
- Communication at Workplace
- Interviews
- Formal Presentations

Books

1. Communication Skills. Sanjay Kumar and PushpLata. Oxford University Press. 2011.
2. Practical English Usage. Michael Swan. OUP. 1995.
3. Remedial English Grammar. F.T. Wood. Macmillan.2007
4. On Writing Well. William Zinsser. Harper Resource Book. 2001
5. Study Writing. Liz Hamp-Lyons and Ben Heasly. Cambridge University Press. 2006.
6. Exercises in Spoken English. Parts. I-III. CIEFL, Hyderabad. Oxford University Press

Syllabus for B.E. Semester I
Humanities

Course Code: HUP151 **Course : English Lab**

L: 0 Hrs. T: 0 Hrs. P: 2 Hrs. Per week **Total Credits: 1**

Course objective

1. To enhance competency of communication in English among learners.

Course outcomes

1. Students learn presentation and public speaking skills
2. Students learn to practice effective strategies for Personal Interview and Group Discussions
3. Students learn and effectively apply language skills – listening, speaking, reading and writing

Syllabus

1. Common Everyday Situations: Conversations and Dialogues
2. Pronunciation, Intonation , Stress, and Rhythm
3. Formal Presentations: Orientation
4. Formal Presentations : Practice Session
5. Interviews: Orientation
6. Interviews: Practice Session
7. Communication at Workplace: Group Discussion- Orientation
8. Communication at Workplace: Practice Session

III Semester

Department of Computer Science & Engineering

Course Code: CST251 | **Course : Fundamentals of Digital Logic and Computer Architecture**

L: 4 Hrs, T: 0 Hr, P: 0 Hr, Per Week | **Total Credits : 04**

Course Objectives

The objective of this course is to familiarize the prospective engineers with:

1. Concepts of digital logic for designing digital circuits.
2. Concepts of organization and architecture of a computer, including basic components like CPU, I/O, bus, pipeline, memory, and design of memory systems.

SYLLABUS

UNIT I Fundamental Concepts of Digital Systems

Overview of Boolean algebra, Minimization of combinational circuits using Karnaugh maps up to five variables, Design procedure of combinational circuits, Code Converters, and their use in realizing Boolean functions.

UNIT II Combinational Circuits

Multiplexers, Demultiplexer, Encoders, Decoders, Adders, Subtractor (Half, Full), BCD Adder/ Subtractor, ripple and carry look-ahead addition.

UNIT III Sequential Circuits

Flip-flops and latches: D, T, J-K, S-R, Master Slave J-K flip-flops Conversion of one FF to another FF. Sequential circuit Analysis, Sequential circuit Design: Counters, asynchronous and synchronous circuit design, Registers and Shift registers.

UNIT IV Basic Structure of Computers

Basic organization of computers, Block level description of the functional units as related to the execution of a program, Instructions set architecture of a CPU, Addressing modes, instruction set classification, Execution of a Complete Instruction, RISC versus CISC architectures, Floating point numbers representation.

UNIT V Memory Organization

Memory Technology, static and dynamic memory, Random Access and Serial Access Memories, Cache memory and Memory Hierarchy, Address Mapping, and memory management unit, Memory Allocation strategies.

Memory Design : RAM Design, Secondary storage – Magnetic disk, Optical disk

UNIT VI Input/Output Organization

I/O mapped I/O and memory mapped I/O, Concept of handshaking, Polled and Interrupt-driven I/O, DMA data transfer, Basic concepts Bus Control.

Pipelining : Basic concepts of pipelining, speedup, Pipeline hazards and their resolution.

Course Outcomes

On completion of the course the student will be able to

1. Design the optimized Digital Logic Circuits.
2. Design the various Combinational and Sequential Circuits.
3. Demonstrate different addressing modes and memory management schemes.
4. Analyze cost performance trade off in designing memory hierarchy and instruction sets.

Text Books

1. Morris Mano; Digital Logic Design; Fourth edition, McGraw Hill
2. V.C.Hamacher, Z.G.Vranesic and S.G.Zaky; Computer Organisation; 5th edition; TataMcGraw Hill,2002.
3. W. Stallings; Computer Organization & Architecture; PHI publication; 2001.

Reference Books

1. A Anand Kumar; Fundamental of Digital Electronics; Second Edition, PHI
2. Computer Organization and Design, by David Patterson and John Hennessey,|| Elsevier. 2008.
3. Computer Architecture and Organization, by Hayes, J.P.1998,McGraw-Hill

III Semester

Department of Computer Science & Engineering

Course Code : CSP251 **Course : Fundamentals of Digital Logic and Computer Architecture Lab**

L: 0 Hrs, T: 0 Hr,P: 2 Hr, Per Week **Total Credits : 01**

Course Objectives

The objective of this course is to familiarize the prospective engineers with:

1. Design of logic gates, combinational and sequential circuits.
2. Understanding of basic components of computer architecture.
3. Understanding of assembly language code.

SYLLABUS

Practical based on CST251 syllabus

Course Outcomes

On Successful completion of course, students will be able to

1. Design the optimized Digital Circuits using AOI logic or universal gates.
2. Implement the Combinational Circuits.
3. Implement the Sequential Circuits.
4. Develop the Assembly language program for any specific processor architecture.

III Semester

Department of Computer Science & Engineering

Course Code: CST252 **Course : Data Structures and Algorithms**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To impart to students the basic concepts of data structures and algorithms.
2. To familiarize students on different searching and sorting techniques.
3. To prepare students to use linear (stacks, queues, linked lists) and non-linear (trees, graphs) data structures.
4. To enable students to devise algorithms for solving real-world problems.

SYLLABUS

UNIT I Data Structures and Algorithms Basics

Introduction : basic terminologies, elementary data organizations, data structure operations; abstract data types (ADT) and their characteristics.

Algorithms: definition, characteristics, analysis of an algorithm, asymptotic notations, time and space tradeoffs.

Array ADT: definition, operations and representations – row-major and column- major.

UNIT II Stacks and Queues

Stack ADT: allowable operations, algorithms and their complexity analysis, applications of stacks – expression conversion and evaluation (algorithmic analysis), multiple stacks.

Queue ADT: allowable operations, algorithms and their complexity analysis for simple queue and circular queue, introduction to double-ended queues and priority queues.

UNIT III Linked Lists

Singly Linked Lists: representation in memory, algorithms of several operations: traversing, searching, insertion, deletion, reversal, ordering, etc. Doubly and Circular Linked Lists: operations and algorithmic analysis. Linked representation of stacks and queues, header node linked lists.

UNIT IV Sorting and Searching

Sorting: different approaches to sorting, properties of different sorting algorithms (insertion, Shell, quick, merge, heap, counting), performance analysis and comparison.

Searching: necessity of a robust search mechanism, searching linear lists (linear search, binary search) and complexity analysis of search methods.

UNIT V Trees

Trees: basic tree terminologies, binary tree and operations, binary search tree [BST] and operations with time analysis of algorithms, threaded binary trees.

Self-balancing Search Trees: tree rotations, AVL tree and operations, B+-tree: definitions, characteristics, and operations (introductory).

UNIT VI Graphs and Hashing

Graphs: basic terminologies, representation of graphs, traversals (DFS, BFS) with complexity analysis, path finding (Dijkstra's SSSP, Floyd's APSP), and spanning tree (Prim's method) algorithms.

Hashing : hash functions and hash tables, closed and open hashing, randomization methods (division method, mid-square method, folding), collision resolution techniques.

Course Outcomes

On completion of the course the student will be able to

1. Analyze the efficiency of algorithms through time and space complexities.
2. Implement different linear data structures (namely stack, queue and linked list).
3. Implement efficient algorithms for searching and sorting.
4. Implement different non-linear data structures (trees and graphs).

Text Books

1. Ellis Horowitz, Sartaj Sahni & Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
2. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002.
3. G.A.V. Pai; Data Structures and Algorithms: Concepts, Techniques and Application; First Edition; McGraw Hill; 2008.

Reference Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein; Introduction to Algorithms; Third Edition; PHI Learning; 2009.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran; Fundamentals of Computer Algorithms; Second Edition; Universities Press; 2008.
3. A. K. Sharma; Data Structures using C, Second Edition, Pearson Education, 2013.

III Semester

Department of Computer Science & Engineering

Course Code : CSP252 **Course : Data Structures and Algorithms Lab**

L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week **Total Credits : 02**

Course Objectives

1. To enable students to employ different searching and sorting methods.
2. To prepare students to identify and apply linear (stacks, queues, linked lists) and non- linear (trees, graphs) data structures in solving problems.
3. To encourage students to design and execute tree-based algorithms for solving real- world problems.

SYLLABUS

Experiments based on CST252 Syllabus in C | C++.

Course Outcomes

On completion of the course the student will be able to

1. Realize different linear data structures.
2. Apply specific methods of searching and sorting to solve a problem.
3. Implement binary search trees and AVL trees.
4. Implement algorithms for graph traversal, shortest paths and spanning trees.

Reference Books

1. K R. Venugopal and Sudeep. R Prasad; Mastering C; Second Edition; McGraw Hill; 2015.
2. Ellis Horowitz, Sartaj Sahni & Susan Anderson-Freed, Fundamentals of Data Structures in C, Second Edition, Universities Press, 2008.
3. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002.

III Semester

Department of Computer Science & Engineering

Course Code : CSP253 **Course : Systems Lab I**

L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week **Total Credits : 02**

Course Objectives

1. Introduce students with basic Python programming concepts
2. Students will learn different data structures supported by python and its applications
3. to develop complex real life python applications.

SYLLABUS

Practicals based on the following syllabus

- Python Execution model and Basic building blocks of Python Programs/Scripts/Modules
- Various keywords, Operators , control and loop constructs used in Python
- User defined Function generation in Python
- Dealing with Python files, Modules and Packages Sci Py, an Open Source Python- based library, which is used in mathematics, scientific computing, Engineering, and technical computing.
- Developing small mathematical applications using packages like Numpy, Matplotlib etc.
- Introduction of with Web scrapping and its need
- Application development to scrape the web with the help of standard libraries like Requests and bs4(Beautiful Soup).

Course Outcomes

On completion of the course the student will be able to

1. Design Python programs using different data and control structures.
2. Use Python Files, Modules and Packages to handle complex python programs
3. Develop mathematical and scientific applications in python using numpy, scipy librarie
4. Develop small applications for web scrapping using standard libraries.

Text Books

1. Learning Python: Poweful object oriented programming, Mark Lutz, O'REILLY publications 5th addition
2. Introduction to Computing & Problem Solving with Python Jeeva Jose and P Sojan Lal Ascher
3. Problem Solving with Algorithms and Data Structures using Python by By Brad Miller andDavid Ranum, 2nd addition

Reference Books

1. Allen Downey ,Jeffrey Elkner ,Chris Meyers,:Learning with Python, Dreamtech Press
2. The Python 3 Standard Library by Example (Developer's Library) by Doug Hellmann, secondedition.

III Semester

Department of Computer Science & Engineering

Course Code : MAT252 **Course : Linear Algebra and Statistics**

L: 2 Hrs, T: 1 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

The objective of this course is to familiarize the prospective engineers with techniques in linear algebra, probability and statistics. It aims to equip the students with standard concepts and tools at an intermediate to advanced level that will serve them well towards tackling more advanced level of mathematics and applications that they would find useful in their disciplines.

SYLLABUS

Module 1 (10-Lectures)

Vector Space; Subspaces; Linear Dependence/Independence; Basis; Dimension; Linear transformation; Range Space and Rank; Null Space and Nullity; Rank nullity theorem, Matrix Representation of a linear transformation; Linear Operators on R^n and their representation as square matrices; Invertible linear operators; Inverse of a non-singular matrix.

Module 2(8-Lectures)

Eigenvalues and eigenvectors of a linear operator; Inner Product Spaces, Norm; Orthonormal Sets, Gram Schmidt orthogonalisation process; projections, positive definite matrices, and Singular Value Decomposition.

Module 3(13-Lectures)

Review of Discrete and continuous random variable, joint probability function, Introduction to stochastic process, random walk, stationary and auto regressive process, transition probability Matrix, Discrete time Markov chain, Continuous time Markov chain.

Module 4(6-lectures)

Hypothesis testing for sampling distributions of means, proportions, sum and differences of means and proportions for large and small samples.

Course Outcomes

On completion of the course the student will be able to

1. Computational techniques and algebraic skills essential for the study of systems of linear equations, matrix algebra, vector spaces, eigenvalues and eigenvectors, orthogonality and diagonalization.
2. Visualization, spatial reasoning, as well as geometric properties and strategies to model, solve problems, and view solutions, especially in R^2 and R^3, as well as conceptually extend these results to higher dimensions.

3. To prepare the background of students to pursue statistical theory or methodology and analyze data in any stream of computer science and information technology.

Text Books

1. Hoffman and Kunze : Linear Algebra, Prentice Hall of India, New Delhi
2. Gilbert Strang : Linear Algebra And Its Applications (Paperback) , Nelson Engineering (2007)
3. M R. Spiegal : Theory and Problems of probability and statistics :,2nd ed, Schaum series.

Reference Books

1. Seymour Lipschutz et al: Linear Algebra, 3rd ed: Schaum series.
2. V. Krishnamoorthy et al : An introduction to linear algebra , Affiliated East West Press, New Delhi P.G. Bhattacharya, S.K. Jain and S.R.
3. Nagpaul : First course in Linear Algebra, Wiley Eastern Ltd., New Delhi
4. K.B.Datta : Matrix and Linear Algebra, Prentice Hall of India, New Delhi
5. W. Feller, An Introduction to Probability Theory and its Applications, Vol. 1, 3rd Ed., Wiley, 1968.
6. S. Ross, A First Course in Probability, 6th Ed., Pearson Education India, 2002.

III Semester
Department of Computer Science & Engineering

Course Code : HUT253 **Course : Business Communication**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

The course aims to develop the skills of students of writing effective business documents and applying effective strategies of verbal business communication.

SYLLABUS

UNIT - I : Fundamentals of Business Communication

Definition of communication and business communication, Objectives of Business Communication, Audience recognition, Barriers of Communication, Product Promotion, Usage of Social Media, Negotiation Skills, Persuasive Communication, PAC concept.

UNIT - II : Technical Writing

Process of Technical Writing, Letters: Job application, Job Description and Resume, enquiry, complaint, order, follow-up, cover/transmittal letters, Sales Letters, and e- mails. Other Forms of Technical Writing: Organizational announcements, Notices, Agenda, Minutes of Meeting, Memorandums.

UNIT - III : Grammar for Writing

Punctuations, Mechanics, Active/ Passive, Transformation of Sentences, Subject-Verb Agreement, Articles, Prepositions.

UNIT - IV : Business Reports

Basic formats and types - Annual, Progress, Project (Project Charter, Project Timeline), Market Search, Sales, Feasibility/Recommendation, Case Study evaluation.

UNIT - V : Preparation of Documents

Visual Appeal: Document Design, Graphics, Tables, User Manuals, Brochures, Fliers.

UNIT - VI : Effective Oral Communication

Non- Verbal Communication, Presentation and Public speaking, Group Discussion.

Course Outcomes

On completion of the course, students will be able to

1. Understand the fundamentals and objectives of business communication, and role of audience in effective communication.
2. Develop technical writing skills and produce effective workplace documents.

3. Apply the rules of English grammar in writing.
4. Develop skills to enhance visual appeal of documents.
5. Evaluate and apply strategies for effective oral communication for professional needs.

Books

1. Sharon Gerson, Steven Gerson, Technical Communication: Process and Product, 2018, Pearson
2. Sanjay Kumar, Pushpa Lata, Communication Skills, 2nd Edition, Oxford Publication, 2018.
3. Shalini Verma, Business Communication, Vikas Publishing House Pvt. Ltd., 2015.
4. P.D. Chaturvedi and Mukesh Chaturvedi, Fundamentals of Business Communication, Pearson Publications, 2012.
5. William Strunk Jr. and E.B. White The Elements of Style, Allyn & Bacon - A Pearson Education Company, 2000.

III Semester
Department of Computer Science & Engineering

Course Code : HUT257 **Course : Cyber Laws and Ethics in IT**

L: 2 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 02**

Course Objectives

1. Describe laws governing cyberspace and analyze the role of Internet Governance in framing policies for Internet security
2. Identify intellectual property right issues in the cyberspace and design strategies to protect your intellectual property
3. Understand the importance of freedom of expression, defamation and hate speech in cyber world.
4. Recognize the importance of digital divide, contingent workers and whistle blowing situations.

SYLLABUS

UNIT I

Cyber laws and rights in today's digital age; IT Act, Intellectual Property Issues connected with use and management of Digital Data, Emergence of Cyberspace, Cyber Jurisprudence.

UNIT II

Cyber Crimes against Individuals, Institution and State, Hacking, Digital Forgery, Cyber Stalking/Harassment, Cyber terrorism, Cyber Defamation, Different offences under IT Act, 2000, Cyber Torts.

UNIT III

Ethics in business world, Ethic s in IT, Ethics for IT professionals and IT users, IT professional malpractices, communications eavesdropping, computer break-ins, denial-of-service, destruction and modification of data, distortion and fabrication of information, Types of Exploits and Perpetrators.

UNIT IV

Intellectual Property: Copy rights, Patents, Trade Secret Laws, Key Intellectual property issues, Plagiarism, Competitive Intelligence, Cybersquatting, Information warfare policy and ethical Issues.

UNIT V

Privacy: The right of Privacy, Protection, Key Privacy and Anonymity issues, Identity Theft, Consumer Profiling, Defamation, Freedom of Expression, Anonymity, National, Security Letters, Defamation and Hate Speech.

UNIT VI

Ethics of IT Organization: Contingent Workers H- IB Workers, Whistle- blowing, Protection forWhistle-Blowers, Handling Whistle- blowing situation, Digital divide.

Course Outcomes:

On successful completion of the course, students will be able

1. Analyze statutory, regulatory, constitutional, and organizational laws that affects the software professional.
2. Evaluate relationship between Ethics and Law with respect to legal dilemmas in the Information Technology ACT.
3. Demonstrate Privacy and Intellectual property rights related ethics issues that are in practices.
4. Distinguish between Business ethics roles applicable to IT users, IT professional Malpractice, IT organization workers

Text Books

1. George Reynolds, “Ethic s in information Technology”,5th edition, Cengage Learning
2. Hon C Graff, Cryptography and E-Commerce - A Wiley Tech Brief, Wiley Computer Publisher, 2001.

Reference Books

1. Michael Cross, Norris L Johnson, Tony Piltzecker, Security, Shroff Publishers and Distributors Ltd.
2. Debora Johnson,” Computer Ethics”,3/e Pearson Education.
3. Sara Baase, “A Gift of Fire: Social, Legal and Ethical Issues, for Computing and the Internet,” PHI Public at ions.
4. Chris Reed & John Angel, Computer Law, OUP, New York, (2007).

IV Semester
Department of Computer Science & Engineering

Course Code : CST254 **Course : Discrete Mathematics and Graph Theory**

L: 4Hrs, T: 0Hr, P: 0 Hr, Per Week **Total Credits : 04**

Course Objectives

1. To teach students predicates, quantifiers, and logical connectives.
2. To derive the solution using deductive logic and evaluate Boolean functions using the properties of Boolean algebra.
3. To develop the given problem using techniques of graph theory.

SYLLABUS

UNIT - I

Relation and Function: Basic concepts of Set theory, Power set, some operations on Sets, Venn diagram, some basic set identities, Cartesian products. Properties of binary relation in a set, Relation matrix and the graph of the relation, Partition and covering of a set. Equivalence relations, Compatibility relations, Compositions of binary relations. Definition and composition of functions, inverse functions and characteristic functions of a set.

UNIT - II

Mathematical Logic: Statement and notations, connectives, Negation, conjunction, disjunction, conditional & bi-conditional, statement formulas & truth tables. Tautologies, equivalence of formulas, Duality law, Tautological implications. Normal Forms – Principal disjunctive and principal conjunctive normal forms. Theory of inference for statement calculus. Theory of inference for predicate calculus.

UNIT - III

Algebraic structures: Semi groups, monoids definition and examples, Group definitions and examples, cyclic group, permutation groups, subgroups and homomorphism, co-sets, Lagrange's theorem and Normal subgroup.

UNIT - IV

Rings and Field: Ring definition and examples, sub rings, Ring homomorphism, ideals and Quotient rings, polynomial rings. Finite field, Galois field, Integral domain.

UNIT - V

Lattice theory and Boolean algebra: Lattices as partially ordered set, Definitions and Examples, some properties of Lattices, Lattices as algebraic system, sub lattices, direct product, homomorphism, some special Lattices. Boolean algebra: Definitions and examples, Application of Boolean Algebra to switching circuits.

UNIT - VI

Graphs and Trees : Graphs and their properties, Degree, Connectivity, Path, Cycle, Sub-Graph, Isomorphism, Eulerian and Hamiltonian Walks, Graph Colouring, Colouring maps and Planar Graphs, Colouring Vertices, Colouring Edges, List Colouring, Perfect Graph, definition properties and Example, rooted trees, trees and sorting, weighted trees and prefix codes, Bi-connected component and Articulation Points, Shortest distances.

Course Outcomes

On successful completion of the course, students will be able

1. Analyze given logic sentence in terms of predicates, quantifiers, and logical connectives.
2. Derive the solution using deductive logic and prove it based on logical inference.
3. Classify the algebraic structure for a given mathematical problem
4. Evaluate Boolean functions and simplify expressions using the properties of boolean algebra.
5. Develop the given problem as graph networks and solve with techniques of graph theory.

Text Books

1. J. P.Tremblay and R. Manohar; Discrete Mathematical Structures with Applications to Computer Science; Tata McGraw-hill Publication 1997.
2. Babu Ram; Discrete Mathematics; Pearson Education, 2011.
3. C.L. Liu and D.P. Mohapatra, Combinatorial Mathematics, 3rd edition Tata Mc Graw Hill..

Reference Books

1. Kenneth H. Rosen, Discrete Mathematics and its Applications, Tata McGraw – Hill
2. Susanna S. Epp, Discrete Mathematics with Applications, 4th edition, Wadsworth Publishing Co. Inc.
3. C L Liu and D P Mohapatra, Elements of Discrete Mathematics A Computer Oriented Approach, 3rd Edition by, Tata McGraw – Hill.

IV Semester
Department of Computer Science & Engineering

Course Code : CST255 **Course : Operating Systems**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To learn the mechanisms of OS to handle processes and threads and their communication
2. To learn the mechanisms involved in memory management in contemporary OS
3. To gain knowledge on distributed operating system concepts that includes architecture, Mutual exclusion algorithms, deadlock detection algorithms and agreement protocols
4. To know the components and management aspects of concurrency management.

SYLLABUS

UNIT - I

Introduction : Concept of Operating Systems, Generations of Operating systems, Types of Operating Systems, OS Services, System Calls, Structure of an OS - Layered, Monolithic, Microkernel Operating Systems, Concept of Virtual Machine. Case study on UNIX and WINDOWS OperatingSystem.

UNIT - II

Processes : Definition, Process Relationship, Different states of a Process, Process State transitions, Process Control Block (PCB), Context switching

Thread : Definition, Various states, Benefits of threads, Types of threads, Concept of multithreads

Process Scheduling : Foundation and Scheduling objectives, Types of Schedulers,

Scheduling criteria : CPU utilization, Throughput, Turnaround Time, Waiting Time, Response Time; Scheduling algorithms: Pre-emptive and Non pre-emptive, FCFS, SJF, RR; Multiprocessor scheduling: Real Time scheduling: RM and EDF.

UNIT - III

Inter-process Communication : Critical Section, Race Conditions, Mutual Exclusion, Hardware Solution, Strict Alternation, Peterson's solution, Producer\Consumer Problem, Semaphores, Monitors, Message Passing, Classical IPC Problems: Reader's & Writer Problem, Dinning Philosopher Problem etc.

UNIT - IV

Deadlocks: Definition, Necessary and sufficient conditions for Deadlock, Deadlock Prevention, Deadlock Avoidance: Banker's algorithm, Deadlock detection and Recovery.

UNIT - V

Memory Management : Basic concept, Logical and Physical address map, Memory allocation: Contiguous Memory allocation – Fixed and variable partition–Internal and External fragmentation and Compaction, Paging: Principle of operation – Page allocation – Hardware support for paging, Protection and sharing, Advantages & Disadvantages of paging.

Virtual Memory : Basics of Virtual Memory – Hardware and control structures – Locality of reference, Page fault, Working Set, Dirty page/Dirty bit – Demand paging, Page Replacement algorithms: Optimal, First in First Out (FIFO), Second Chance (SC), Not recently used (NRU) and Least Recently used (LRU).

UNIT - VI

I/O Hardware : I/O devices, Device controllers & Device drivers, Secondary-Storage

Structure : Disk structure, Disk scheduling algorithms

File Management : Concept of File, Access methods, File types, File operation, Directory structure, File System structure, Allocation methods, Free-space management, directory implementation, efficiency and performance.

Disk Management : Disk structure, Disk scheduling - FCFS, SSTF, SCAN, C-SCAN, LOOK, C-LOOK, Disk reliability, Disk formatting, Boot-block, Bad blocks.

Course Outcomes

On successful completion of the course, students will be able to demonstrate

1. Contrast differing structures for operating systems
2. Analyze the role of various components (process, page, file systems etc) of operating system.
3. Design solutions for challenges in inter process communication.
4. Implement resource (CPU, Memory, Disk) management policies.

Text Books

1. Operating System Concepts, 8th Edition by A. Silberschatz, P.Galvin, G. Gagne, Wiley India Edition.
2. Modern Operating Systems, 2nd Edition by Andrew Tanenbaum, PHI.

Reference Books

1. Operating Systems: Internals and Design Principles, 5th Edition, William Stallings, Prentice Hall of India.
2. Understanding the Linux Kernel, 3rd Edition, Daniel P. Bovet, Marco Cesati, O'Reilly.

IV Semester

Department of Computer Science & Engineering

Course Code : CSP255 **Course : Operating Systems Lab**

L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week **Total Credits : 02**

Course Objectives

Using C language in Linux environment

1. To develop ability of students to design and implement concepts of operating systems such as system calls, CPU scheduling, process/thread management.
2. To develop the components and management aspects of concurrency management, memory management, and File management.

SYLLABUS

Experiments based on CST255 Syllabus.

Course Outcomes

On completion of the course the student will be able to demonstrate

1. Implement system commands by making use of LINUX system calls.
2. Implement processes and process schedulers.
3. Design solutions to process synchronization and deadlock handling.
4. Implement Memory management and File management solutions.

IV Semester
Department of Computer Science & Engineering

Course Code : CST256 **Course : Object Oriented Programming**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To make students understand Fundamental features of an object oriented language like Java: object classes and interfaces, exceptions and libraries of object collections
2. Introduce students with fundamental concepts like exception handling, generics, multithreading and streams.

SYLLABUS

UNIT I

Features of Object Oriented Programming languages, Abstraction, Encapsulation, Inheritance, polymorphism and late binding.Concept of a class, Access control of members of a class, instantiating a class, constructor and method overloading.

UNIT II

Concept of inheritance, methods of derivation, use of super keyword and final keyword in inheritance, run time polymorphism, abstract classes and methods, Interface, implementation of interface, creating packages, importing packages, static and non-static members, Lambda Expressions Introduction, Block, Passing Lambda expression as Argument.

UNIT III

Exceptions, types of exception, use of try catch block, handling multiple exceptions, using finally, throw and throws clause, user defined exceptions, Introduction to streams, byte streams, character streams, file handling in Java, Serialization.

UNIT IV

Generics, generic class with two type parameter, bounded generics. Collection classes: Arraylist, LinkedList, Hashset, Treeset .

UNIT V

Multithreading: Java Thread models, creating thread using runnable interface and extending Thread, thread priorities, Thread Synchronization, InterThread communications.

Basic SQL commands, DDL and DML commands, Java Database Connectivity, Working with Connection, Statement and Resultset, Data Manipulation using JDBC, Data navigation.

UNIT VI

Introduction to Design Patterns, Need of Design Pattern, Classification of Design Patterns, Role of Design Pattern in Software design, Creational Patterns, Structural Design Patterns and Behavioral Patterns.

Course Outcomes

On successful completion of the course, students will be able to demonstrate

1. Inspect the features of object oriented programming, classes, objects and methods.
2. Develop programs based on different Java concepts (namely exception handling, generics and collections).
3. Implement multithreading, I/O streams and database connectivity.
4. Analyze characteristics and need of design pattern in software design process.

Text Books

1. Herbert Schildt; JAVA The Complete Reference; Ninth Edition, Tata McGraw- Hill Publishing Company Limited.
2. Design Patterns By Erich Gamma, Pearson Education.

Reference Books

1. Cay S. Horstmann and Gary Cornell; Core JAVA Volume-II Advanced Features; Eighth Edition; Prentice Hall, Sun Microsystems Press 2008.
2. Herbert Schildt and Dale Skrien; Java Fundamentals A Comprehensive Introduction; Tata McGraw- Hill Education Private Ltd 2013.

IV Semester
Department of Computer Science & Engineering

Course Code : CSP256 **Course : Object Oriented Programming Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week **Total Credits : 01**

Course Objectives

1. To develop ability of students to implement basic concepts and techniques of object oriented programming paradigm like encapsulation, inheritance, polymorphism, exception handling.
2. Develop solution to problems using collection classes, generics, streams, multithreading and JDBC.

SYLLABUS

Experiments based on CST256 Syllabus.

Course Outcomes

On completion of the course the student will be able to

1. Execute programs based on features of object oriented programming, classes, objects and methods.
2. Develop applications based on different Java concepts (namely exception handling, generics and collections).
3. Implement multithreading and I/O streams.
4. Perform database connectivity using a structured persistent database.

IV Semester

Department of Computer Science & Engineering

Course Code : CST257 **Course : Formal Language and Automata Theory**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To provide students an understanding of basic concepts in the theory of computation.
2. To teach formal languages and various models of computation.
3. To exhibit fundamental concepts related with computability theory.

SYLLABUS

UNIT - I

Basics of Sets and Relation, Countability and Diagonalisation, Principle of mathematical induction, Pigeon-hole principle. Fundamentals of formal languages and grammars, Chomsky hierarchy of languages.

UNIT - II

Finite automata : Deterministic finite automata (DFA), Nondeterministic finite automata (NFA) and equivalence with DFA, Minimization of finite automata, NFA with Epsilon Transitions, Finite Automata with output.

UNIT - III

Regular expressions and Regular languages, Regular grammars and equivalence with finite automata, properties of regular languages, pumping lemma for regular languages, Context-free grammars (CFG) and language(CFL), parse trees, ambiguity in CFG, Reduction of CFGs, Chomsky and Greibach normal forms.

UNIT - IV

Push Down Automata : Deterministic pushdown automata and Non-Deterministic pushdown automata, Acceptance by two methods: Empty stack and Final State, Equivalence of PDA with CFG, closure properties of CFLs.

UNIT - V

Turing machines : The basic model for Turing machines (TM), Turing recognizable (recursively enumerable) and Turing-decidable (recursive) languages, variants of Turing machines, unrestricted grammars and equivalence with Turing machines, TMs as enumerators.

UNIT - VI

Undecidability : Church-Turing thesis, Universal Turing machine, Undecidable problems about languages, Recursive Function Theory.

Course Outcomes

On successful completion of the course, students will be able to demonstrate

1. Analyze the formal relationships among machines, languages and grammars.
2. Design an optimized finite automata for given regular language.
3. Design Push Down Automata, Turing Machine for given languages.
4. Apply computability, decidability, recursive function theory for problem solving.

Text Books

1. John E. Hopcroft, Rajeev Motwani and Jeffrey D. Ullman, Introduction to Automata Theory, Languages, and Computation, Pearson Education Asia.

Reference Books

1. Harry R. Lewis and Christos H. Papadimitriou, Elements of the Theory of Computation, Pearson Education Asia.
2. Dexter C. Kozen, Automata and Computability, Undergraduate Texts in Computer Science, Springer.
3. Michael Sipser, Introduction to the Theory of Computation, PWS Publishing.
4. John Martin, Introduction to Languages and The Theory of Computation, Tata McGraw Hill.

IV Semester

Department of Computer Science & Engineering

Course Code : CST258 **Course : System Programming and Device Driver**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To introduce the concepts and principles of system programming.
2. To introduce the procedure for designing and implementing system programs like assembler, macroprocessor, loader etc.
3. To introduce BIOS and DOS interrupts.
4. To develop simple utilities including device drivers and advance input/output.

SYLLABUS

UNIT - I

Assembler- Introduction to System Programming & its components, Machine Architecture, Basic Assembler functions, Machine dependent & Machine Independent Assembler Features, Assembler Design, design of single pass and multi pass Assembler.

UNIT - II

Macroprocessor - Basic Macro Processor Functions, Machine Independent Macro Processor Features, Design of macro processor.

UNIT - III

Linker and Loader - Basic Loader Functions, Concept of static and dynamic relocation, external symbols, Machine dependent & Machine Independent Loader Features, Loader Design Options.

UNIT - IV

Video and Keyboard Operation – Introduction to Video and Keyboard Processing, Video Systems, Keyboard Processing.

UNIT - V

Advanced Input/Ouput: Facilities for using the Mouse, Disk storage I: organization, Disk storage II: Writing and Reading Files Disk Storage III: INT 21H functions for Support Disks and Files, Disk Storage IV: INT 13H Disk Functions, Facilities for Printing.

UNIT - VI

UNIX Device Drivers - Definition, Anatomy and Types, Device Programming, Installation and Incorporation of driver routines, Basic device driver operation, Implementation with Line Printer, Comparative study between device drivers for UNIX & Windows, TSR Programming.

Course Outcomes

On successful completion of the course, students will be able to demonstrate

1. Analyze the working and purpose of assembler, macro-processor, linker, loader, device driver.
2. Implement general design procedure of linker and loader for creating executable program from an object module created by assembler and compiler.
3. Implement various functions to perform video and keyboard operation.
4. Analyze various operation of advanced input/output device.

Text Books

1. Leland L. Beck; System Software: An introduction to systems programming; Pearson Education; 3rd edition; 1997.
2. D. M. Dhamdhere; System Programming and Operating systems; Tata McGraw Hill Education; 2nd edition; 1999.
3. George Pajari; UNIX Device Drivers; Pearson Education; 1993.
4. Peter Abel,Assembly Language Programming,5th Edition ,Pearson Education,2003.
5. Rajesh K. Maurya; System Programming; Dreamtech Press,2011.

Reference Books

1. J. J. Donovan; System Programming; Tata McGraw Hill Education; 2011 reprint
2. Sivarama P. Dandmudi, Introduction to Assembly Language Programming, Springer 1st Edition 2003.
3. Keringham and Pike; UNIX programming Environment; PHI, 1984.

IV Semester

Department of Computer Science & Engineering

Course Code : CSP258 **Course : System Programming and Device Driver Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week **Total Credits : 01**

Course Objectives

1. To learn the principles of processing of system software programs.
2. To acquire skills of system programming utility tools.

SYLLABUS

Experiments based on CST258 Syllabus.

Course Outcomes

On completion of the course the student will be able to

1. Demonstrate working of different of system software.
2. Interpret the working of various system utilities and tools.
3. Learn the working of device drive in UNIX.
4. Implement interrupts required for video and keyboard processing.

Text Books

1. Leland L. Beck; System Software: An introduction to systems programming; Pearson Education; 3rd edition; 1997
2. Peter Abel, Assembly Language Programming,5th Edition ,Pearson Education,2003
3. Sivarama P. Dandmudi, Introduction to Assembly Language Programming, Springer 1st Edition 2003.

Reference Books

1. J. J. Donovan; System Programming; Tata McGraw Hill Education; 2011 reprint
2. Keringham and Pike; UNIX programming Environment; PHI, 1984.

IV Semester

Department of Computer Science & Engineering

Course Code : CSP259 **Course : Systems Lab II**

L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week **Total Credits : 02**

Course Objectives

- Understand UI/UX basics and its use in software industry
- Understand basic use cases of UI/UX.
- Develop small utilities using UI/UX tools
- Develop and integrate UI/UX with basic programs

Syllabus

1. HTML : Creation of headers, paragraphs , links , importing of images, tables, designing of forms, and document structure of HTML
2. Style Sheets: CSS3 - Introduction to Cascading Style Sheets-Features-Core syntax - Style Sheets and HTML Style Rule, Text Properties
3. HTML5: Use of Linear gradient in text, Navigation in Webpage, Multimedia based tags- audio, video, iframe, Creating Animations
4. Client- Side Programming: Introduction to JavaScript, Syntax, Variables and Data Types, Statements, Operators, Literals, Functions, Objects-Arrays-Built-in Objects, Form Validation
5. Data Visualization: Canvas JS Library, High Charts Library
6. Angular JS: Introduction, Features of Angular JS ,Model-View-Controller, Built-In Filters, Using Angular JS Filters, Creating Custom Filters, Controllers & Modules, Working with Angular Forms, Model Binding, Bootstrapping

Course Outcomes

On successful completion of the course, students will be able to:

1. Design UI/UX use cases using web technologies.
2. Design storytelling and typography for requirement specification.
3. Use data visualization tools to develop interfaces for use cases.
4. Develop small applications using voice technology, motion design, and animationCST351.

Text Books

1. UI/UX design for designer and developers: by Nathan Clark
2. User Story Mapping software for agile age [Paid subscription on yearly basis]
3. User story mapping by Jeff Patton, O'Reilly Publication

IV Semester

Department of Computer Science & Engineering

Course Code : CHT252 **Course : Environmental Science**

L: 2 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 00**

SYLLABUS

Principle of contaminant behaviour and recent trends in environmental pollution control.

I. Air pollution and its control techniques: (4 lectures)

Contaminant behaviour in the environment, Air pollution due to SOx, NOx, photochemical smog, Indoor air pollution

Natural pathways for degradation: Carbon cycle, Sulphur cycle, Nitrogen cycle, Oxygen cycle.

Factors responsible for altering the composition of atmosphere (deforestation, burning of fossil fuels, industrial and vehicular emissions, CFCs).

Techniques to control Air pollution, ambient air quality and continuous air quality monitoring, Control measures at source, Kyoto Protocol, Carbon Credits.

II. Noise pollution and its control techniques: (2 lectures)

Introduction to noise pollution and its causes

Noise pollution control: Recent advances in noise pollution control and benefits.

III. Soil pollution and its control techniques: (5 lectures)

Soil pollution : Soil around us, Soil water characteristics, soil pollution.

Solid waste management : Composting, vermiculture, landfills, hazardous waste treatment, bioremediation technologies, conventional techniques (land farming,constructed wetlands), and phytoremediation.

Degradation of xenobiotics in environment : Petroleum hydrocarbons, pesticides, heavy metals

IV. Water pollution and its control techniques: (8 lectures)

Major sources of water pollution : Eutrophication, acid mine drains, pesticides and fertilizers, dyeing and tanning, marine pollution, microplastics

Techniques to control water pollution : Conventional waste water treatment-types of sewage, sewerage system, alternative systems, primary, secondary and tertiary processes including aerobic and anaerobic techniques, safe disposal.

Case studies : Treatment schemes for waste water from dairy, textile, power plants, pharmaceutical industries, and agro based industries such as rice mills.

V. E-wastes (2 lectures)

Introduction, types of e-wastes, environmental impact, e-waste recycling, e-waste management rules.

VI. Environmental Sustainability: Role of Green technology (5 lectures)

Concept of green technologies, categories, goals and significance, sustainability

Green energy, green chemistry, challenges to green technology, advantage and disadvantages of green processes, Eco mark certification- its importance and implementationVII-Different government initiatives (2 lectures)

National ambient air quality standard 2009, Swacch Bharat Abhiyan, National afforestation program and Act- 2016, National river conservation plan, Formation of National Green Tribunal

Course Outcomes

On successful completion of the course, students

1. Will get sufficient knowledge regarding different types of environmental pollutions, their causes, detrimental effects on environment and effective control measures.
2. Will realize the need to change an individual's outlook, so as to perceive our environmental issues correctly, using practical approach based on observations and self-learning.
3. Will become conversant with recent waste management techniques such as E-wastes, its recycling and management.
4. Will gain knowledge about the modes for sustainable development, importance of green energy and processes.
5. Will be able to identify and analyze environmental problems as well as risks associated with these problems and greener efforts to be adopted, to protect the environment from getting polluted.

Suggested Books

1. Benny Joseph, Environmental Studies, Mc Graw Hill Education (India) Private Limited
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut
3. P Aarne Vesilind, J. Jeffrey Peirce and Ruth F. Weiner, Environmental Pollution and Control, Butterworth-Heinemann
4. D. D. Mishra, S. S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S.Chand & Company Ltd. Sultan Chand & Company
5. Shree Nath Singh, Microbial Degradation of Xenobiotics, Springer-Verlag Berlin Heidelberg
6. P.T. Anastas & J.C. Warner, Green Chemistry: Theory & practice, Oxford University Press
7. P. Thangavel & Sridevi, Environemental Sustainability: Role of Green technologies, Springer publications.

V Semester
Department of Computer Science & Engineering

Course Code : CST351 **Course : Database Management Systems**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To understand the role of a database management system in an organization.
2. To construct simple and advanced database queries using a data language.
3. To understand and apply logical database design principles and database normalization.
4. To recognize the need for transaction management and query processing.

SYLLABUS

UNIT - I : Introduction to Database System Concepts and Architecture

Databases and Database Users, Characteristics of the Database Approach, Advantages of Using the DBMS Approach, When Not to Use a DBMS, Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment. Introduction to NoSQL databases and In-Memory databases.

UNIT - II : The Relational Data Model and SQL

Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations, SQL Data Definition, Data Types and Constraints, Data Management in SQL, Transforming ER Model into Relational Model.

UNIT - III : Database Design and Normalization

Functional Dependencies, Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decomposition, Normal Forms Based on Primary Keys, General Definitions of Second and Third Normal Forms, Boyce-Codd Normal Form, Other Dependencies and Normal Forms.

UNIT - IV : Indexing and Hashing

Ordered Indices, B+-Tree Index Files and its Extensions, Static Hashing and Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Some General Issues Concerning Indexing.

UNIT - V : Query Processing and Optimization

Measures of Query Cost, Query Operation: Selection, Sorting and Join Operation, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans.

UNIT - VI : Transaction Processing, Concurrency Control and Recovery

Introduction to Transaction Processing, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Two-Phase Locking Techniques for Concurrency Control, Deadlock Handling and Multiple Granularity, Database Recovery Techniques.

Course Outcomes

On completion of the course the student will be able to

1. Model data requirements for an application using conceptual modeling tools.
2. Design database schemas by applying normalization techniques.
3. Execute efficient data storage and retrieval queries using SQL.
4. Use concurrency control and database recovery in transaction management.

Text Books

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan; Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri and Shamkant Navathe; Fundamentals of Database Systems, Sixth Edition, Addison Wesley 2011.

Reference Books

1. Raghu Ramakrishnan and Johannes Gehrke; Database Management Systems; Third Edition; Tata McGraw Hill Publication, 2003.
2. C. J. Date; Database in Depth – Relational Theory for Practitioners; O`Reilly Media, 2005.

V Semester
Department of Computer Science & Engineering

Course Code : CSP351 **Course : Database Management Systems Lab**

L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week **Total Credits : 02**

Course Objectives

1. To enable students to use DDL, DML and DCL.
2. To prepare students to conceptualize and realize database objects (tables, indexes, views and sequences) and execute SQL queries.
3. To encourage students to design and execute PL/SQL blocks and triggers.

SYLLABUS

Experiments based on CST351 Syllabus in Oracle11g|MySQL.

[Few experiments to be conducted to demonstrate handling of databases on cloud]

Course Outcomes

On completion of the course the student will be able to

1. Demonstrate database user administration and authorizations.
2. Execute simple, nested, multiple table, and advanced queries for data retrieval.
3. Construct PL-SQL block structure and Trigger for specific application.
4. Implement various integrity constraints, views, sequences, indices and synonym on database.

Reference Books

1. James Groff, Paul Weinberg and Andy Oppel, SQL - The Complete Reference, 3rd Edition,McGraw Hill, 2017.

V Semester

Department of Computer Science & Engineering

Course Code : CST352 **Course : Design and Analysis of Algorithms**

L: 3 Hrs, T: 1 Hr, P: 0 Hr, Per Week **Total Credits : 04**

Course Objectives

1. Students should learn techniques for effective problem solving in computing.
2. Students should analyze different paradigms of problem solving to solve a given problem in efficient way.

SYLLABUS

UNIT - I

Mathematical foundations for arithmetic and geometric series, Recurrence relations and their solutions, Principles of designing algorithms and complexity calculation, Asymptotic notations for analysis of algorithms, worst case and average case analysis, amortized analysis and it's applications.

UNIT - II

Divide and Conquer- basic strategy, Binary Search, Quick sort, Merge sort, Strassen's matrix multiplication, Maximum sub-array problem, Closest pair of points problem, Convex hull problem.

UNIT - III

Greedy method – basic strategy, fractional knapsack problem, Minimum cost spanning trees, Huffman Coding , activity selection problem ,Find maximum sum possible equal to sum of three stacks, K Centers Problem.

UNIT - IV

Dynamic Programming - basic strategy, Bellmen ford algorithm, all pairs shortest path, multistage graphs, optimal binary search trees, traveling salesman problem, String Editing, Longest Common Subsequence problem and its variations.

UNIT - V

Basic Traversal and Search Techniques, breadth first search and depth first search, connected components. Backtracking basic strategy, 8-Queen's problem, graph coloring, Hamiltonian cycles, sum of subset problem, Introduction to Approximation algorithm.

UNIT - VI

NP-hard and NP-complete problems, basic concepts, non-deterministic algorithms, NP-hard and NP complete, decision and optimization problems, polynomial reduction ,graph based problems on NP Principle , vertex cover problem, clique cover problem

Course Outcomes

On successful completion of the course, students will be able to:

1. Analyze efficiency of algorithms using mathematical formulation, and recurrence relations methodologies.
2. Design Greedy and Divide & Conquer algorithms and their usage in real life examples.
3. Design Dynamic programming and Backtracking Paradigms to solve the real life problems.
4. Solve NP class problems using standard approaches.

Text Books

1. Thomas H. Cormen et al; Introduction to Algorithms; 3 Edition; Prentice Hall, 2009.
2. Horowitz, Sahani and Rajasekaram; Computer Algorithms, Silicon Press, 2008.
3. Brassard and Bratley; Fundamentals of Algorithms, 1 Edition; Prentice Hall, 1995.
4. Richard Johnsonbaugh, Algorithms, Pearson Publication, 2003.

Reference Books

1. Parag Himanshu Dave, Balchandra Dave, Design and Analysis of Algorithms, Pearson Education, O'relly publication
2. Richard Johnson baugh, Algorithms, Pearson Publication, 2003.

V Semester

Department of Computer Science & Engineering

Course Code : CSP352 **Course : Design & Analysis of Algorithms Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week **Total Credits : 01**

Course Objectives

1. Analyze the performance of algorithms.
2. Demonstrate a familiarity with major algorithms and data structures.
3. Apply important algorithmic design paradigms and methods of analysis.

SYLLABUS

Experiment based on syllabus of Design and Analysis Algorithms (CST352).

Course Outcomes

On successful completion of the course, students will be able to:

1. Implement greedy algorithms to solve real world problems.
2. Implement divide-and-conquer algorithms to solve real world problems.
3. Implement algorithms using Dynamic Programming Approach.
4. Apply backtracking paradigm to realize real world problems.

Text Books

1. Thomas H. Cormen et.al. Introduction to Algorithms, Prentice Hall of India.
2. Horowitz, Sahani, Rajsekharam, Computer Algorithms, Galgotia Publications Pvt. Ltd.

Reference Books

1. Brassard, Bratley, Fundamentals of Algorithms , Prentice Hall
2. Algorithms - A Creative Approach, 3RD Edition, UdiManber, Addison-Wesley, Reading, MA.

V Semester
Department of Computer Science & Engineering

Course Code : CST353 **Course : Computer Networks**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To develop an understanding of modern network architectures from a design and performance perspective.
2. To introduce the student to the major concepts involved in network protocols.
3. To provide an opportunity to do network programming

SYLLABUS

UNIT - I

Data communication Components : Representation of data and its flow Networks, Various Connection Topology, Protocols and Standards, OSI model, Transmission Media, LAN: Wired LAN, Wireless LANs, Techniques for Bandwidth utilization: Multiplexing - Frequency division, Time division and Wave division

UNIT - II

Data Link Layer : Error Detection and Error Correction - Fundamentals, Block coding, Hamming Distance, CRC; Flow Control and Error control protocols - Stop and Wait, Go back – N ARQ, Selective Repeat ARQ.

UNIT - III

Medium Access Sub Layer : Switching, Random Access, Multiple access protocols - Pure ALOHA, Slotted ALOHA, CSMA/CD, CDMA/CA, IEEE 802, standard protocols.

UNIT - IV

Network Layer : Internet Protocol (IP) – Logical Addressing: IPV4, IPV6; Address mapping: ARP, RARP, BOOTP and DHCP–Delivery, Forwarding and Unicast Routing protocols.

UNIT - V

Transport Layer : Elements of Transport protocols: Addressing, Connection establishment, Connection release, Crash recovery, User Datagram Protocol (UDP), Transmission Control Protocol (TCP), TCP Congestion Control; Quality of Service, QoS improving techniques: Leaky Bucket and Token Bucket algorithm.

UNIT - VI

Application Layer : Domain Name Space (DNS), DDNS, TELNET, EMAIL, File Transfer Protocol (FTP), WWW, HTTP, SNMP, Bluetooth, Firewalls

Course Outcomes

On successful completion of the course, students will be able to:

1. Inspect the technical fundamentals in data communication and computer networks.
2. Analyze the architecture of OSI and TCP/IP model
3. Analyze the design issues of each layer of OSI model
4. Implement the protocols at different layers of OSI model

Text Books

1. Computer Networks : 5th ed by Andrew. S. Tanenbaum. PHI Publication.
2. Data Communications and Networks: 3rd ed by Behrouz A. Forouzan. Tata McGraw Hill Publication.

Reference Books

1. James F. Kurose and Keith W. Ross: Computer Networking: A Top-Down Approach Featuring the Internet, 3rd Edition.
2. William Stallings, -Data and Computer Communications, PHI 6th Edition

V Semester
Department of Computer Science & Engineering

Course Code : CSP353 **Course : Computer Networks Lab**

L:0 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits : 01**

Course Objectives

1. To introduce use of different network simulation software.
2. To analyze performance of different protocols at various layers of a network architecture.
3. To demonstrate the implementation of various networking concepts.

SYLLABUS

Experiments based on CST353 Syllabus.

Course Outcomes

On successful completion of the course, students will be able to:

1. Simulate and then configure different types of networks.
2. Design the implementation strategies for services of datalink, MAC layer
3. Implement networking concepts like server, client and addressing mechanism.
4. Implement networking concepts like server, client and addressing mechanism.

V Semester
Department of Computer Science & Engineering

Course Code : CSP354 **Course : Mobile Application Programming Lab**

L: 0 Hrs, T: 0 Hr, P: 4 Hr, Per Week **Total Credits : 02**

Course Objectives

The objective of this course is to develop the ability of students to design android applications. Use various features of android like broadcast receivers, services, threads, content providers etc. Effectively use files and database to store the data. Use location based services to develop navigation based applications.

SYLLABUS

- UI Widgets and Layout Manager
- Activity, Intent & Fragment
- Android Menu
- Data Storage
- Android Service
- Android Notification, Dialog, SMS and Broadcast Receiver
- SQLite and Content Provider and Location Services
- Introduction to IOS, IOS app development basics, Introduction to XCode.

Course Outcomes

On successful completion of the course, students will be able to:

1. Design of basic android applications using the user interface (UI) elements of android OS.
2. Use Android's APIs for data storage, retrieval, preferences, files, databases, and content providers to create android apps.
3. Implement Android's communication APIs for sending SMS, utilize background services, location-based services, broadcast receiver.
4. Develop small IOS applications.

Text Books

1. Beginning Android Programming with Android Studio, 4 Ed by J. F. DiMarzio, Wrox publication.
2. Professional Android 4 Application Programming by Reto Meier, Wiley Publication

Reference Book

1. Android Programming for Beginners - Second Edition by John Horton, Packt Publishing Pvt. Ltd.

V Semester
Department of Computer Science & Engineering

Course Code : CST355-1 **Course : Computer Graphics (Elective-I)**

L:3 Hrs, T: 0 Hr, P: 0 Hrs, Per Week **Total Credits : 03**

Course Objectives

The computer graphics course prepares students for activities involving in design, development and testing of modeling, rendering, shading and animation. Students will use the standard OpenGL library in several programming projects illustrating the theory and practice of programming computer graphics applications.

SYLLABUS

UNIT - I

Introduction to Graphics : Importance of Computer Graphics, Graphics Hardware, Application of Computer Graphics, Raster and Vector Graphics, Raster scan display system, Raster graphics Algorithm, Video Controller, Input Devices for Interactive Operation.

UNIT - II

Windows Graphics Programming (WGP): Introduction to Windows and APIs, WGP Fundamentals, Graphics Device Interface (GDI), Graphics Programming Languages, GDI Coordinate System.

UNIT - III

Polygon filling methods : Scan Conversion Algorithms: Simple Ordered edge list, Edge Fill, Fence Fill and Edge Flag Algorithm, Seed Fill Algorithms: Simple and Scan Line Seed Fill Algorithm.

UNIT - IV

2D Clipping algorithms for regular and irregular windows: Sutherland Cohen Out code, Sutherland Cohen Subdivision, Mid-Point subdivision, Cyrus Beck Algorithm, Polygon Clipping Algorithms.

UNIT - V

2D Transformations, Normalized Device Coordinates, Viewing Transformations, 3D System Basics and 3D Transformations, Parallel and Perspective Projections.

UNIT - VI

Hidden line & hidden surface removal algorithms, Back face detection, Rendering, Shading, Ray tracing techniques, Illumination methods and Color Systems.

Course Outcomes

On successful completion of the course, students will be able to:

1. Analyze various graphics devices and graphics programming language to design a graphics application.

2. Implement different scan conversion techniques.
3. Apply windowing, clipping and transformations algorithms to render the graphics.
4. Apply the concepts of color models, lighting and shading models, hidden surface elimination and rendering models to enhance the image.

Text Books

1. Rogers; Procedural Elements of Computer Graphics; 3rd Edition; McGraw Hill, 2001.
2. Newman and Sproull; Principles of Interactive Computer Graphics; McGraw Hill, 1989.
3. Hearn and Baker; Computer Graphics; 2nd Edition; PHI, India, 1994.
4. Ivan Harringhton; Computer Graphics - A Programming Approach; McGraw Hill Publications, 1987.
5. Computer Graphics Using OPENGL- 2nd edition , F.S. Hill Jr. Pearson Education, 2003

Reference Books

1. James D. Foley, Andries Van Dam, Feiner Steven K. and Hughes John F. – Computer Graphics: Principles & Practise, Adddison Wesley Publishing House

V Semester
Department of Computer Science & Engineering

Course Code : CST355-2 **Course : Embedded Systems (Elective-I)**

L: 3Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To introduce the concepts and principles of ARM Architecture for embedded system.
2. To introduce the programming model of ARM processor Architecture.
3. To introduce and learn Embedded Operating Systems.

SYLLABUS

UNIT - I

ARM Architecture ARM Design Philosophy, Registers, PSR, Pipeline, Interrupts and Vector Table, Architecture Revision, ARM Processor Families.

UNIT - II

ARM Programming Model-I Instruction Set: Data Processing Instructions, Branch, Load, Store Instructions, PSR Instructions, Conditional Instructions.

UNIT - III

ARM Programming Model-II Thumb Instruction Set: Register Usage, Other Branch Instructions, Data Processing Instructions, Single-Register and Multi Register Load- Store Instructions, Stack, Software Interrupt Instructions

UNIT - IV

ARM Programming Simple C Programs using Function Calls, Pointers, Structures, Integer and Floating Point Arithmetic, Assembly Code using Instruction Scheduling, Register Allocation, Conditional Execution and Loops.

UNIT - V

Firmware & Boot Loader, examples, Embedded Operating Systems, Fundamental Components, Examples Simple Little Operating system. SLOS Directory Layout, Initialization, Memory Model, Interrupts and Exceptions Handling, Scheduler, Context Switch, Device Driver Framework.

UNIT - VI

Memory Management Cache Architecture, Polices, Flushing and Caches, MMU, Page Tables, Translation, Access Permissions, Content Switch.

Course Outcomes

On successful completion of the course, students will be able to:

1. Understand the Architecture of ARM processor.
2. Understand the ARM processor programming.
3. Understand the Embedded Operating System fundamentals.
4. Understand the Memory Management of ARM processor.

Text Books

1. ARM Systems Developer's Guides- Designing & Optimizing System Software – Andrew N.Sloss, Dominic Symes, Chris Wright, 2008,Elsevier.

Reference Books

1. Embedded Microcomputer Systems, Real Time Interfacing – Jonathan W. Valvano – Brookes / Cole, 1999, Thomas Learning.

V Semester

Department of Computer Science & Engineering

Course Code : CST355-3 **Course : Information Theory and Coding (Elective-I)**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. Introduce the principles and applications of information theory.

2. To teach study how information is measured in terms of probability and entropy, and the relationships among conditional and joint entropies.

3. To teach coding schemes, including error correcting codes.

4. Explain how this quantitative measure of information may be used in order to build efficient Solutions to multitudinous engineeering problems.

SYLLABUS

UNIT - I : Introduction

Information source, Symbols, and Entropy, Mutual Information, Information measures for continuous Random Variable

UNIT - II : Source Coding

The source coding theorem, Kraft inequality, Shannon-Fano codes, Huffman codes, Arithmetic Codes, Lempel-Ziv-Welch algorithm, universal source codes

UNIT - III : Channel Capacity

Channel capacity; Noisy channel coding theorem for discrete memory-less channels; Channelcapacity with feedback; Continuous and Gaussian channels

UNIT - IV : Error Control Coding

Linear block codes and their properties, hard-decision decoding, convolution codes and the Viterbi decoding algorithm, iterative decoding; turbo codes and low density- parity-check codes.

UNIT - V : Rate Distortion Theory

Rate distortion function, random source codes; joint source-channel coding and the separation theorem

UNIT - VI : Cyclic and BCH Code

Generator polynomial, Encoding and decoding cyclic codes, RS code, Berlekemp algorithm, Galois Fields, definition & construction of BCH code.

Course Outcomes

After successful completion of this course, student will be able to

1. Apply information theory and linear algebra in source coding and channel coding
2. Analyse various error control encoding and decoding techniques
3. Analyse the performance of error control codes
4. Apply Polynomial generator and Galois Field Theory in the field of Cryptography.

Text Books

1. Ranjan Bose, - Information Theory, coding and cryptography||,TMH,2011
2. Salvatore Gravano - Introduction to Error control codes||, Oxford, 2001.
3. Wade Trape, Lawrence C Washington - Introduction to Cryptography with Coding Theory||, Pearson, 2011.

Reference Books

1. Reza, "An Introduction to Information Theory", Dover 1994
2. T. M. Cover and J. A. Thomas," Elements of Information Theory", John Wiley & Sons, New York, 1991.
3. R. Hill, "A First Course in Coding Theory", Oxford University Press, 1986
4. L. Hanzo, T.H. Liew and B.L. Yeap, "Turbo coding, turbo equalization and space- time coding for transmission over fading channels", John Wiley and Sons, 2002.

V Semester

Department of Computer Science & Engineering

Course Code : CST355-4 **Course : Design Patterns (Elective-I)**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To learn the fundamentals of software design by referring a catalog of design patterns:
2. Demonstrate how to use design patterns to address code design and user interface issues.
3. Identify the most suitable design pattern to address a given application design problem.
4. Apply design principles (e.g., open-closed, dependency inversion, etc.).
5. Critique code by identifying and refactoring anti-patterns.

SYLLABUS

UNIT - I

Elements of Design Pattern, Describing Design Pattern, Design Pattern Classification, Role of design Patterns in software design, how design patterns solve design problems, selection and use of Design Pattern, Example implementation of design pattern using UML

UNIT - II : Creational Patterns

Creational Design pattern: Introduction, Role of Creational pattern, instantiation of objects using creational patterns, Types (Factory method, Abstract Factory, Builder, Prototype, Singleton), Structure and comparison of various types of creational patterns, Examples of creational patterns.

UNIT - III : Structural Design Patterns:

Structural Design Pattern : Introduction, Role of Structural pattern, creating flexible and efficient arrangement of objects and classes using structural patterns, Types (Adapter, Bridge, Composite, Decorator, Façade, Proxy), Structure and comparison of various types of structural patterns, Examples of structural patterns, Comparative study of Creational and Structural Design patterns

UNIT - IV : Behavioral Patterns-I

Behavioral Design pattern : Introduction, Role of Behavioral pattern, Types: Interpreter Design pattern, Language grammar handling using interpreter design pattern, Template Method, Implement run-time variable on template design pattern, Iterator design pattern, Handling aggregate objects using Iterator design pattern,Chain of Responsibility principle, Methodology of responsibility sharing using request passing approach, Example of functional responsibility of object.

UNIT - V : Behavioral Patterns-II

Mediator Design Pattern, Analysis of Mutual Behavior of classes, Observer Design Pattern, Effect of single object on set of objects, Reference control between objects, State Design Pattern, State-wise

behavior of object, Strategy Design pattern, selecting an algorithm at runtime, Memento Design pattern and its implementation

UNIT - VI : Case Study: Designing a Document Editor:

Design Problems, Document Structure, Formatting, Embellishing the User Interface, Supporting Multiple Look-and-Feel Standards, Supporting Multiple Window Systems, User Operations, Spelling Checking and Hyphenation, Summary, Complexity computation of Various Design Patterns.

Course Outcomes

On successful completion of the course, students will be able to:

1. Analyze the need and ability of design patterns in the software design process.
2. Implement various solutions for creation of objects, their structure and the interaction between objects.
3. Develop a loosely coupled application using design patterns.
4. Analyze the tradeoffs of applying a design pattern to a given problem.

Text Books

1. Design Patterns by Erich Gamma, Pearson Education
2. Design Patterns Explained by Alan Shalloway and James Trott, Addison-Wesley; 2nd edition

Reference Books

1. Pattern's in JAVA Vol-I by Mark Grand , Wiley DreamTech.
2. Pattern's in JAVA Vol-II by Mark Grand , Wiley DreamTech.
3. JAVA Enterprise Design Patterns Vol-III by Mark Grand , Wiley DreamTech.
4. Head First Design Patterns by Eric Freeman, O'Reilly

V Semester

Department of Computer Science & Engineering

Course Code : HUT353 **Course : Indian Traditional Knowledge**

L: 2 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 0**

Course Objective

The course is designed with the objective of developing understanding of the students about the essence of Indian traditional knowledge in terms of its scientific approach, legality, role in natural resource protection, as well as its contribution to philosophy and art.

Course Outcomes

On successful completion of the course, students will have increased ability to understand the importance and application of:

1. Indian Knowledge system and its scientific approach.
2. Traditional knowledge and protection of nature.
3. The legality and its importance for the protection of Indian traditional knowledge.
4. Indian philosophical tradition.
5. Indian artistic tradition

SYLLABUS

1. Basic Structure of Indian Traditional Knowledge: Vedas, Upavedas, Vedang, Upadang, scientific approach
2. Ecology and Indian Traditional Knowledge: Meaning, role, case studies
3. Intellectual Property Rights and Indian traditional Knowledge: Meaning, role in protection of Indian traditional knowledge, cases studies
4. Indian Philosophical traditions: Nyay, Sankaya, Yog, Mimansa, Jainism, Buddhism, Sikhism, and other approaches
5. Indian Artistic Traditions: Chitrakala, Murtikala, Vastukala, Sangeet, Sthpatya, Nritya evam Sahitya, case studies.
6. Knowledge of traditional Indian Science and Technology

Reference Material

1. Amit Jha (2009), Traditional Knowledge System in India, Atlantic Publishers and Distributors.
2. RR Gaur, Rajeev Sangal, GP Bagaria, Human Values and Professional Ethics (Excel Books, New Delhi, 2010)

3. V. Sivaramakrishanan (ed.), Cultural Heritage of India – Course material, Bharatiya VidyaBhavan, Mumbai, 5th Edition, 2014

4. Swami Jitatmanand, Modern Physics and Vedant, Bharatiya Vidya Bhavan

5. Swami Jitatmanand, Holistic Science and Vedant, Bharatiya Vidya Bhavan

6. S.C. Chatterjee and D.M. Datta, An introduction to Indian Philosophy, University of Calcutta, 1984

7. Pramod Chandra, Indian Arts, Howard University Press, 1984

8. Krishna Chaitanya, Arts of India, Abhinav Publications, 1987

9. https://www.researchgate.net/publication/299625768_Traditional_Knowledg e_syst ems_in_ India_for_biodiversity_conservation/link

VI Semester
Department of Computer Science & Engineering

Course Code : CST356 **Course : Artificial Intelligence**

L:3 Hrs, T: 0 Hr, P: 0 Hrs, Per Week **Total Credits : 03**

Course Objectives

1. To understand challenges involved in designing intelligent systems.
2. To represent given problem using state space representation and solve it by using different search techniques.
3. To understand knowledge representation methods using logic programming.
4. To understand uncertainty theory in designing AI systems.
5. To understand learning methods in solving AI problems.

SYLLABUS

UNIT - I

Introduction: Basics of problem solving, problem representation; Search Techniques: Problem size, complexity; Uninformed search techniques: Depth, Breadth, Uniform Cost, Depth Limited, Iterative deepening DFS.

UNIT - II

Informed search techniques : Heuristic Based Search, Greedy Based First Search, A* Search; Local Search algorithms: Hill-climbing, Simulated Annealing, Genetic Algorithms.

UNIT - III

Constraint Satisfaction Problems, Adversarial Search: Two player Games, The min- max algorithm, Alpha-Beta pruning.

UNIT - IV

Propositional Logic: Inference, Equivalence, Validity and satisfiability, Resolution, Forward and Backward Chaining, First Order Logic: Syntax and Semantics of FOL, Inference in FOL, Unification, Forward Chaining, Backward Chaining, and Resolution.

UNIT - V

Uncertainty Knowledge and Reasoning: Probability and Baye's Theorem, Statistical reasoning: Bayesian networks, Naïve bayes algorithm, Fuzzy Logic, Introduction to expert system

UNIT - VI

Learning : Types of Learning, k-nearest neighbor, Decision Tree Learning, Artificial Neural Network, Perceptron Learning algorithm

Course Outcomes

On successful completion of the course, students will be able to:

1. Apply uninformed and informed search techniques on it.
2. Solve the fully informed two player games using different AI techniques.
3. Solve the AI problems by using logic programming
4. Apply uncertainty theory based on techniques like probability theory and fuzzy logic.
5. Apply learning methods in solving AI problems.

Text Book

1. Stuart Russel and Peter Norvig; Artificial Intelligence: A Modern Approach; Third Edition; Pearson Education, 2009.

Reference Book

1. E.Rich, K. Knight, S. B. Nair; Artificial Intelligence; 3rd Edition; Tata McGraw Hill, 2014.
2. Denis Rothman; Artificial Intelligence By Example: Develop machine intelligence from scratch using real artificial intelligence use cases; Kindle Edition, Packt Publishing Ltd, 2018

VI Semester
Department of Computer Science & Engineering

Course Code : CSP356 **Course : Artificial Intelligence Lab**

L:0 Hrs, T: 0 Hr, P: 2 Hrs, Per Week **Total Credits : 01**

Course Objectives

1. To understand the concept behind design of AI problems.
2. To demonstrate the use of logic programming for solving AI problems.
3. To learn the use of probability and learning models for solving AI problems.

SYLLABUS

Practicals based on CST356 syllabus.

Practical will be performed in Python with OpenAI/ core AI tool.

Course Outcomes

On successful completion of the course, students will be able to:

1. Implement different AI toy problems by using search techniques.
2. Design two player games using min-max algorithm with Alpha-Beta pruning.
3. Simulate AI problems using logic programming.
4. Implement probabilistic based methods to solve classification problems.
5. Implement different learning methods for solving AI problems.

VI Semester
Department of Computer Science & Engineering

Course Code : CST357 **Course : Software Engineering**

L:3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To make students a successful professionals in the field with solid fundamental knowledge of software engineering.
2. To prepare students with strong communication and interpersonal skills, as well as professional and ethical principles when functioning as members and leaders of multi-disciplinary teams.
3. To teach students how to apply their foundations in software engineering to adapt to readily changing environments using appropriate theory, principles and processes.

SYLLABUS

UNIT - I

Introduction to Software Engineering, Software engineering principles, Software Myths, Software Engineering- A Layered Technology, Software Process Framework, Requirements Engineering Tasks, Requirement Engineering Process, Eliciting Requirement: Case Study Software Requirements Specification.

UNIT - II

Software Process Models, The Waterfall Model, Incremental Process Models, Evolutionary Process Models, Specialized Process Models, The Unified Process Model, COCOMO Model, Agile Process Models, Agile metrics, Extreme Programming (XP), Scrum, Kanban, Software Deployment, Case Study.

UNIT - III

Basic concepts of testing, Testing Life Cycle, Structural Testing, Functional Technique, Static testing, Dynamic testing, Unit Testing, Integration Testing, Validation Testing, System Testing, Debugging. Software Testing fundamentals, Black Box Testing, White Box Testing, Web Testing, Test case design, building, execution, Automated Testing

UNIT - IV

Software Project management- Plans, Methods and Methodology, The Business Case, Project Success and Failure, Project Evaluation, Cost-benefit evaluation technique, Project Planning-stepwise project Planning, Software Effort Estimation- Albrecht Function Point Analysis, COSMIC Function Point, Cost Estimation, Project Scheduling.

UNIT - V

An overview, Software Quality, A Framework for Product Metrics, Metrics for Analysis & Design Models, Metrics for Source Code, Metrics for Testing & Maintenance. Metrics for process & project - Software measurement, metrics for software quality, metrics for small organization, Managing people in software environment.

UNIT - VI

Risk management - Risk strategies, Software risks, Risk identification, Risk refinement, R M M M, Risk Response development & Risk Response Control, Risk Analysis: Agile risk management using Jira, Change Management- Software Configuration Management, SCM Repository, SCM Process, Estimation, Software re-engineering, Reverse engineering: A practical approach, Project Technical Writing: User manuals, Software Installation guides etc.

Course Outcomes

On successful completion of the course, students will be able to:

1. Implement software engineering practices and various models.
2. Apply software engineering processes to modeling and solving real-world problems.
3. Analyze impact of different software testing strategies.
4. Apply approaches to assessment of software quality and management.

Text books and Reference books

1. Roger Pressman; Software Engineering-A Practitioner's Approach; Sixth Edition, MaGraw Hill, 2010
2. Project Management by Clifford F. Gray, Erik W. Larson, McGraw Hill
3. Ian Somerville; Software Engineering; Seventh Edition; Pearson Education. 2008.
4. Ethics in Information Technology, George W. Reynalds, 4th Edition, Cengage Leraning Publication
5. David Gustafsan, Software Engineering; Schaum's Series, Tata McGraw Hill,2002
6. Sanjay Mohapatra; Software Project Management, First Edition, Cengage Learning, 2011.
7. Rajib Mall, Software Project Management, 5th Edition, McGrawHill

VI Semester

Department of Computer Science & Engineering

Course Code : CSP357 **Course : Software Engineering Lab**

L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week **Total Credits : 01**

Course Objectives

1. To teach students UML modeling tool employed in the software development life cycle.
2. To make students familiar with the hundreds of hierarchical and interrelated engineering requirements necessary for large and/or complex systems.
3. To teach students software testing tools employed in the software testing.
4. To teach students prototyping tool employed in the software industry to develop software prototype.

SYLLABUS

Practical based on CST357 syllabus.

Course Outcomes

After successful completion of this course, the student should able to:

1. Analyze the software engineering problem(s) to provide intended solution (SRS).
2. Design different structural models for the underlying problem.
3. Design different behavioral models for the underlying problem.
4. Implement the constructed model using white box testing.
5. **Implement the constructed model using black box testing.**

VI Semester
Department of Computer Science & Engineering

Course Code : CST358 **Course : Compiler Design**

L:3 Hrs, T: 0 Hr, P: 0 Hrs, Per Week **Total Credits : 03**

Course Objectives

1. To understand the theory and practice of compiler implementation.
2. To explore the principles, algorithms, and data structures involved in the design and construction of compilers.
3. To understand various phases of compiler and their working.

SYLLABUS

UNIT - I

Introduction to Compilers : Introduction to Compilers, Phases of compiler design, Relating Compilation Phases with Formal Systems

Lexical Analysis : Lexical analysis, tokens, pattern and lexemes, Design of Lexical analyzer, Regular Expression, transition diagram, recognition of tokens, Lexical Errors.

UNIT - II

Syntax Analysis : Specification of syntax of programming languages using CFG, Top- down parser, design of LL(1) parser, bottom up parsing technique, Handle and Viable Prefix, LR parsing, Design of SLR, CLR, LALR parsers, Parser Conflicts, Handling Ambiguous Grammars, Applications of the LR Parser.

UNIT - III

Syntax directed translation : Study of syntax directed definitions & syntax directed translation schemes, Type and Type Checking, A Simple Type Checking System, implementation of SDTS, intermediate notations- postfix, syntax tree, TAC, translation of Assignment Statement, expressions, controls structures, Array reference.

UNIT - IV

Storage allocation & Error Handling : Run time storage administration stack allocation, Activation of Procedures, Storage Allocation Strategies, Garbage Collection, symbol table management, Error detection and recovery- lexical, syntactic and semantic.

UNIT - V

Code optimization : Machine-independent Optimisation- Local optimization techniques, loop optimization- control flow analysis, data flow analysis, Loop invariant computation, Induction variable removal, other loop optimization techniques, Elimination of Common sub expression, and Machine-dependent Optimization techniques.

UNIT - VI

Code generation : Problems in code generation, Simple code generator, code generation using labelling algorithm, Register allocation by Graph Colouring, Code Generation by Dynamic Programming.

Course Outcomes

After successful completion of the course students will be able to:

1. Analyze the role of various phases of compilation and relate it with the formal system.
2. Design various types of parsers with string parsing and error handling.
3. Implement syntax directed translation schemes for different programming language constructs.
4. Implement different code optimization and code generation techniques using standard data structures.

Text Books

1. Aho, Sethi, and Ullman; Compilers Principles Techniques and Tools; Second Edition, Pearson education, 2008.
2. Alfred V. Aho and Jeffery D. Ullman; Principles of Compiler Design; Narosa Pub.House, 1977.
3. Manoj B. Chandak, Khushboo P Khurana; Compiler Design; Universities Press, 2018.

Reference Books

1. Vinu V. Das; Compiler Design using Flex and Yacc; PHI Publication, 2008.
2. V. Raghavan; Principles of Compiler Design, McGraw Hill Education (India), 2010.

VI Semester
Department of Computer Science & Engineering

Course Code : CSP358 **Course : Compiler Design Lab**

L: 0 Hr, T: 0 Hr, P: 4 Hrs, Per Week **Total Credits : 02**

Course Objectives

This laboratory course is intended to make the students experiment on the basic techniques of compiler construction and use of various tools for implementation. This will provide deeper insights into the aspects of programming languages and various phases of compiler.

SYLLABUS

Experiments based on syllabus of Complier Design (CST358).

Course Outcomes

On successful completion of the course, students will be able to

1. Use Open Source tools to create a lexical analyzer and parser.
2. Implement different types of Parsing techniques.
3. Implement various syntax directed translation schemes to generate intermediate code.
4. Implement various code optimization techniques and code generation algorithms.

Text Books

1. Doug Brown, John Levine, Tony Mason, Lex and Yacc, O'Reilly Media, 2nd Edition, 2012.
2. Des Watson, A Practical Approach to Compiler Construction, Springer, 1st ed. edition, 2017.

VI Semester

Department of Computer Science & Engineering

Course Code : CST359-1 **Course : Advanced Algorithms (Elective-II)**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To demonstrate a familiarity with major algorithms and data structures.
2. To analyze different algorithms with their practical applications.
3. To create efficient algorithms to address engineering problems.

SYLLABUS

UNIT - I

Hashing : Review of Hashing, Hash Function, Collision Resolution Techniques in Hashing, Separate Chaining, Open Addressing, Analysis of Open and Closed Hashing, Rehashing, Hash Tables with Worst-Case O(1) Access: Perfect Hashing, Cuckoo Hashing, Hopscotch Hashing, Extendible Hashing.

UNIT - II

Red Black Trees : Height of a Red Black Tree, Red Black Trees Bottom-Up Insertion, Top-Down Red Black Trees, Top-Down Deletion in Red Black Trees, Analysis of Operations.

Splay Trees : Splaying, Search and Update Operations on Splay Trees, Amortized Analysis of Splaying.

UNIT - III

B-Trees : Advantage of B- trees over BSTs, Height of B-Tree, Search and Update Operations on B-Trees, Analysis of Operations, Introduction to B+ Trees

Garbage Collection : Review, Challenges, Recent Trends, Memory Management Interface, Mark-and-Sweep: Garbage Collection Algorithm, Garbage Collection in Java

UNIT - IV

Text Processing : String Operations, Brute-Force Pattern Matching, Boyer-Moore Algorithm, Rabin-Karp Algorithm, String Matching with Finite Automata, the Knuth- Morris-Pratt Algorithm, Multiple Longest Common Subsequence Problem (MLCS).

UNIT - V

Computational Geometry: One Dimensional Range Searching, Two Dimensional Range Searching, Constructing a Priority Search Tree, Searching a Priority Search Tree, Priority Range Trees, Quad-trees, k-D Trees, Applications.

UNIT - VI

Randomized Algorithms : Need for Randomized Algorithms, Approaches, Approx Weighted Vertex Cover, Randomized Max 3-SAT, Randomized MST, Randomized Median Finding, Probabilistic Max Cut, Randomized Quicksort, Primality Testing, Approximation Algorithm, Sum of Subset Problem.

Course Outcomes

On successful completion of the course, students will be able to:

1. Implement different advanced data structures and algorithms.
2. Use advanced data structures and algorithms to solve engineering problems.
3. Analyze different algorithms with their practical applications.
4. Create efficient algorithms to address engineering problems.

Textbooks

1. Mark Allen Weiss, Data Structures and Algorithm Analysis in C++, Fourth Edition, Pearson Education, 2002.
2. Horowitz, Sahni and Rajasekaran, Computer Algorithms, Universities Press, 2000.
3. Cormen, Leiserson, Rivest and Stein, Introduction to Algorithm, Third edition, PHI, 2009.

References

1. Aho, Hopcroft and Ullman, Data Structures and Algorithms, Pearson Education, 2002.
2. M T Goodrich, Roberto Tamassia, Algorithm Design, John Wiley, 2002.
3. Tanenbaum, Langram and Augestien, Data Structures using C and C++, Prentice Hall of India, 2002.

VI Semester

Department of Computer Science & Engineering

Course Code : CST359-2 **Course : Distributed Systems (Elective-II)**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

This course introduces students to principles, design and implementation of distributed system. The lecture focus primarily on the principles and design of distributed systems and cover communication, distributed storage, naming, synchronization, scheduling, fault tolerance and recovery.

SYLLABUS

UNIT - I

Introduction to Distributed systems : Examples of distributed systems, challenges, issues in distributed operating systems, communication primitives, Theoretical Foundations - inherent limitations of a distributed system, Lamports logical clocks, vector clocks, casual ordering of messages, global state, cuts of a distributed computation, termination detection.

UNIT - II

Distributed Mutual Exclusion : introduction, the classification of mutual exclusion and associated algorithms (token based and non-token based approach), a comparative performance analysis.

UNIT - III

Distributed Deadlock Detection : Introduction, deadlock handling strategies in distributed systems, issues in deadlock detection and resolution ,control organizations for distributed deadlock detection, centralized and distributed deadlock detection algorithms, hierarchical deadlock detection algorithms. Agreement protocols – introduction, the system model, a classification of agreement problems, solutions to the Byzantine agreement problem

UNIT - IV

Distributed File system : Introduction to DFS, design issues, File service architecture, Distributed shared memory: design issues, Architecture, algorithms for implementing DSM, memory coherence and protocols

UNIT - V

Distributed Scheduling : Introduction, issues in load distributing, components of a load distributing algorithm, load distributing algorithms, performance comparison, selecting a suitable load sharing algorithm, requirements for load distributing, task migration and associated issues.

UNIT - VI

Failure Recovery : Introduction, classification of failures, consistent set of check points, synchronous and asynchronous check pointing and recovery. Fault Tolerance: Introduction, Atomic Actions and

committing, Commit protocols, Non Blocking Commit Protocols, Voting Protocols, Dynamic Voting Protocols.

Course Outcomes

After successful completion of this course, the student will be able to,

1. Apply knowledge of basic distributed system techniques and concepts.
2. Identify issues in mutual exclusion, deadlock detection, and agreement protocols in the context of distributed systems.
3. Realize design issues for distributed file system, distributed shared memory and distributed scheduling.
4. Recognize the importance of fault tolerance and failure recovery in a distributed environment.

Text Books

1. Advanced concepts in Operating Systems – Singhal and Shivratri; McGraw Hill
2. Coulouris, Dollimore, Kindleberg; Distributed Systems Concepts and Design, Fourth Edition, Pearson education, 2009.
3. Distributed Systems An Algorithmic Approach, Second Edition, Sukumar Ghosh, CRC Press.

Reference Books

1. Andrew S. Tanenbaum; Distributed Operating System; Pearson education; 2003.
2. Pradeep K. Sinha, "Distributed Operating System-Concepts and Design", PHI, 2003.

VI Semester

Department of Computer Science & Engineering

Course Code : CST359-3 **Course : Digital Signal Processing (Elective-II)**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To make students aware about the meaning and implications of the properties of systems and signals.
2. To make students familiar with the most important methods in DSP, including digital filter design, transform-domain processing and importance of Signal Processors.

SYLLABUS

UNIT - I

Introduction to digital signal processing : Discrete time signals & systems: Discrete time signals and its classification, Discrete time systems, Classification of discrete time systems, Linear convolution, Cross Correlation.

UNIT - II

The Z-transform : Z-transforms, Inverse Z-transform, properties of z-transform, Concepts of zeros and poles of a system, region of convergence (ROC) of z- transform.

UNIT - III

Structures for realization of LTI discrete-time systems in z domain : IIR systems: Direct Form-I, Direct Form-II, Cascade form and parallel form. FIR systems: Direct form, cascade form and linear phase realization.

UNIT - IV

Frequency domain representation of discrete time signals and systems: Fourier transform of discrete time signals, properties of discrete time Fourier transform, Frequency response analysis of discrete time systems.

UNIT - V

Discrete Fourier Transform : Discrete Fourier transform definition, properties of DFT, circular convolution, Decimation in time FFT algorithm, decimation in frequency FFT algorithm, Inverse FFT.

UNIT - VI

Filter design Techniques: Design of discrete time IIR filters from continuous time filters, Design of FIR filters by windowing method – Hamming and Kaiser. Introduction to DSP processor and its applications, Recent Trends/Developments.

Course Outcomes

On Successful completion of course, students will be able to:

1. Analyze different frequency domain signals.
2. Design system architectures using Z transforms.
3. Analyze DFT & FFT algorithms.
4. Design filters to suit specific requirements for applications

Text Books

1. Discrete time signal processing: Alan V. Oppenheim, Ronald W. Schafer & Buch, Pearson Education.
2. Digital Signal Processing: Salivahanan, Tata McGraw Hill.

Reference Books

1. Digital Signal Processing Theory and application: Proakis and Manolakis, PHI Ltd.
2. Digital Signal Processing: Sanjit K. Mitra, Tata McGraw Hill.
3. Digital Signal Processing: Jonathan Stein, Wiley India Ltd.

VI Semester

Department of Computer Science & Engineering

Course Code : CST359-4 **Course : Data Warehousing and Mining (Elective-II)**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

This course gives an introduction to methods and theory for development of data warehouses and data analysis using data mining. Data quality and methods and techniques for preprocessing of data. Modeling and design of data warehouses. Algorithms for classification, clustering and association rule analysis.

SYLLABUS

UNIT - I

Introduction to Data Warehouse, Data Warehouse basic Concepts, Architecture of Data Warehouse, Overview of ETL and OLAP OLTP integration – comparison of OLAP with OLTP systems, ROLAP, MOLAP and HOLAP, Multidimensional modeling

UNIT - II

Data Cube, Data Cube Computation methods, Advanced SQL support for OLAP, Data Preprocessing-Data Cleaning methods, Descriptive Data Summarization, Data Reduction, Data Discretization and Concept hierarchy generation

UNIT - III

Space Management in Data warehouse - Schemas for storing data in warehouse using different storage structures, B-tree index, hash index, clusters, Bitmap index functional index, domain index, Data partitions.

UNIT - IV

Introduction : What is Data mining? Data Mining on what kind of data, Data mining Functionalities, Classification of Data Mining Systems, Major Issues on Data mining, KDD Process, Association Rule mining.

UNIT - V

Classification and Prediction : Classification by decision tree induction, Bayesian Classification, Rule-based Classification, Associative Classification.

UNIT - VI

Clustering : Measuring Data Similarity and Dissimilarity Partition based Clustering, Hierarchical based clustering, Density based clustering.

Course Outcomes

After successful completion of this course, the student will be able to,

1. Use the fundamental theories and concepts of data warehousing in real life application.
2. Apply multi-dimensional modeling techniques in designing data warehouses.
3. Implement the principles of data mining for designing data mining applications.
4. Apply different methods and techniques involved in data mining.

Text books

1. Jaiwei Han and Micheline Kamber; Data Mining Concepts and Techniques; 2 edition; Morgan Kaufmann Publishers, 2006.
2. Tang and MacLennan, Data Mining with SQL Server 2005, Wiley Publishing, 2005
3. Data Warehousing and Fundamentals by Paulraj Ponniah, A Wiley-Interscience Publication

Reference Books

1. Michale Corey, Michale Abbey; Oracle 8i Data Warehousing; Tata McGraw Hill.
2. Fundamentals of Database Systems, Navathe and Elmasry, Addison Wesley, 2000.

VI Semester
Department of Computer Science & Engineering

Course Code : CSP360 **Course : Project-1**

L: 0 Hrs, T: 0 Hr, P: 6 Hr, Per Week **Total Credits : 03**

Course Outcomes

On completion of this course the student will be able to

1. Undertake problem identification, formulation, and analysis of project statement by investigating various domains and society needs.
2. Perform requirement analysis and design methodology for solving the identified problem.
3. Apply advanced programming techniques and modern tools for the design and development of a solution.
4. Demonstrate ethical principles, project management skills and team work.
5. Communicate technical information employing written reports and presentations.

Scope

Students are expected to approach to solving a real-world problem in providing effective and efficient software solution through team effort.

VI Semester

Department of Computer Science & Engineering

Course Code : CSP361 **Course : Comprehensive Viva**

L: 0 Hrs, T: 0 Hr, P: 2 Hr, Per Week **Total Credits : 01**

Course Objectives

1. To assess the overall knowledge of the student in Computer Science and Engineering.
2. To assess preparedness of the student for placements and entrance examinations for higher learning, viz. GATE, GRE, CAT, etc.
3. To facilitate the students in selecting appropriate career track for themselves.

SYLLABUS

The Comprehensive Viva will cover the contents from the courses, both the theory and the lab practice which the student learnt during third thru sixth semester of the undergraduate programme.

Mode of Conduction

- The students will be assessed using process (to be decided by department) for the Internal Assessment Component.
- The comprehensive viva (End Semester Component) shall be conducted by a committee consisting of one external examiner and two internal examiners.

Course Outcomes

On completion of the course the student will be able to

1. Respond to the queries and issues covering computing domain studied during second and third year of study.
2. Exhibit oral presentation skills and inter-personal skills.
3. Apply domain knowledge to succeed in competitive technical examinations
4. Apply ethical approach to develop professional practice skillset.

VII Semester

Department of Computer Science & Engineering

Course Code : CST451-1 **Course : Machine Learning**

L: 3 Hrs, T: 0 Hr, P: 0 Hr, Per Week **Total Credits : 03**

Course Objectives

1. To introduce the basic concepts and techniques of machine learning.
2. To understand major machine learning algorithms.
3. To identify machine learning techniques suitable for a given problem.

Course Syllabus

UNIT - I

The concept learning task, General-to-specific ordering of hypotheses, Version spaces, Inductive bias, Decision Tree Learning, Rule Learning: Propositional and First-Order, Over-fitting, Cross-Validation, Experimental Evaluation of Learning Algorithms.

UNIT - II

Instance-Based Learning : K-Nearest neighbor algorithm, Radial basis functions, Case- based learning. Computational Learning Theory: probably approximately correct (PAC) learning, Sample complexity, Computational complexity of training, Vapnik Chervonenkis dimension.

UNIT - III

Artificial Neural Networks : Linear threshold units, Perceptron, Multilayer networks and back-propagation, recurrent networks.

UNIT - IV

Probabilistic Machine Learning : Maximum Likelihood Estimation, MAP, Bayes Classifiers Naive Bayes, Bayes optimal classifiers, Minimum description length principle.

UNIT - V

Bayesian Networks, Inference in Bayesian Networks, Bayes Net Structure Learning Unlabelled data: EM, preventing over fitting, Gaussian Mixture Models, K- means and Hierarchical Clustering.

UNIT - VI

Clustering and Unsupervised Learning, Hidden Markov Models, Reinforcement Learning, Support Vector Machines, Ensemble learning: boosting, bagging.

Course Outcomes

On successful completion of the course, students will be able to:

1. Solve the problems related to the fundamental concepts in machine learning.
2. Analyse the strengths and weaknesses of various machine learning approaches.
3. Apply machine learning algorithms to solve classification, regression and clustering problems.
4. Implement various machine learning models to efficiently solve real-world problems.

Text Books

1. Tom Mitchell; Machine Learning- an Artificial Intelligence Approach, Volume-II; Morgan Kaufmann, 1986.
2. Christopher Bishop, Pattern Recognition and machine learning; Springer Verlag, 2006.

Reference Books

1. Soumen Chakrabarti; Mining the Web: Discovering Knowledge from Hypertext Data, Morgan-Kaufmann, 2003.
2. A. K. Jain and R. C. Dubes; Algorithms for Clustering Data; Prentice Hall PTR, 1988.
3. Ethem Alpaydin, Introduction to Machine Learning, PHI.

VII Semester

Department of Computer Science & Engineering

Course Code : CSP451-1 **Course : Machine Learning Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 01**

Course Objectives

1. To implement basic machine learning algorithm for solving problem.
2. To understand the usage of datasets in implementing machine learning problems.
3. To learn various modern tools, packages and techniques for machine learning.

Course Syllabus

Experiments based on CST451-1(Machine Learning) Syllabus. Technology: Python.

Course Outcomes

On completion of the course the student will be able to

1. Implement fundamental concepts used in machine learning algorithms.
2. Implement python programs for various learning algorithms.
3. Apply appropriate machine learning algorithms to various data sets.
4. Apply machine learning algorithms to solve real world problems.

Text Books

1. Tom Mitchell; Machine Learning- an Artificial Intelligence Approach, Volume-II; Morgan Kaufmann, 1986.
2. Christopher Bishop, Pattern Recognition and machine learning; Springer Verlag, 2006.

Reference Books

1. Soumen Chakrabarti; Mining the Web: Discovering Knowledge from Hypertext Data, Morgan-Kaufmann, 2003.
2. A. K. Jain and R. C. Dubes; Algorithms for Clustering Data; Prentice Hall PTR, 1988
3. Ethem Alpaydin, Introduction to Machine Learning, PHI

VII Semester

Department of Computer Science & Engineering

Course Code: CST451-2 **Course: Web Intelligence and Big Data**

L: 3Hrs, T: 0Hr, P: 3Hr, Per Week **Total Credits : 03**

Prerequisite Courses

Data Structure & Algorithms, Computer Architecture, Operating System, Database Management Systems

Course Objectives

1. To understand the importance of qualitative data, get insights and techniques.
2. To understand the principles, tools and methods of web intelligence.
3. To optimize business decisions and create competitive advantage with Big Data analytics.
4. To explore the fundamental concepts of big data analytics.
5. To learn to analyze the big data using intelligent techniques.

Syllabus

UNIT - I

Introduction to Web Intelligence, Architecture of a Web search engine, Web Indexing, Inverted indexes - Construction, Query processing; Link Analysis - Page Rank, Modified page rank, Search Engine Optimization using page rank; Finding Similar Items: Applications of Near-Neighbor Search, Shingling of Documents, Locality Sensitive hashing, Distance Measures.

UNIT - II

Information and Language, Web Data Mining, Mining Data Streams, Web Scraping for information extraction, Importance of Words- TF, IDF, TF-IDF, Analyzing Sentiment and Intent Load, Mutual information, Naïve bayes classifier and Bayesian networks.

UNIT - III

Recommender system - long tail problem, content-based recommendations, Collaborative filtering- Item based and user based, Frequent Itemsets, Graph based clustering, mining social network graphs.

UNIT - IV

Introduction to Big Data- Characteristics, Challenges and applications; Introduction to Big Data Stack, Introduction to Big Data Platforms, Hadoop: Features, advantages, Hadoop 1.0 - Hadoop2.0, overview of hadoop ecosystems, Hadoop Distributed File System, HBase Architecture, Introduction to Map Reduce, Internal working of Map - Reduce, Map-reduce way of designing solutions with examples.

UNIT - V

Consistency Availability Partition Tolerance (CAP), Eventual Consistency, Consistency Trade-O-s, Basically Available Soft State Eventual Consistency (BASE), Introduction to Cassandra, Architecture, Data Replication in Cassandra, Data model: cluster, keyspace, column family, Cassandra Keyspace Operations, CURD Operations, Cassandra CQL: data types, collections.

UNIT - VI

Introduction to Big Data Applications (Machine Learning), Overview of Big Data Machine Learning, Mahout Introduction, Introduction to Machine Learning with MLlib, Linear and logistic regression,

Course Outcomes

On Successful classification and clustering with Big Data tool.completion of this course, students will able to:

1. Apply Web analytics and artificial intelligence on web-based systems to improve their performance.
2. Demonstrate information retrieval, working of recommender systems, and extraction of data from the web.
3. Develop Big Data Solutions using Map-Reduce method and Hadoop Eco System.
4. Implement various functionalities of the NoSQL database and Machine Learning Techniques to address analyzing large data sets.

Text Books

1. Leskovec, Rajaraman, Ullman, Mining of Massive Datasets, Cambridge University Press.
2. Tom White; Hadoop: The Definitive Guide, 4th Edition, O'Reilly, 2015.
3. Hien Luu; Beginning Apache Spark 2: With Resilient Distributed Datasets, Spark SQL, Structured Streaming And Spark Machine Learning Library, Apress, 2018
4. Bart Baesens, Analytics in a Big Data World: The Essential Guide to Data Science and its Applications, Wiley, 2014
5. Michael Minelli and Michele Chambers; Big Data, Big Analytics: Emerging Business Intelligence and Analytic trends for Today's Business, John Wiley & Sons, 2013.
6. Judith Hurwitz and Alan Nugent; Big Data for Dummies; John Wiley & Sons, 2013.

References

1. Eric Siegel, Thomas H. Davenport; Predictive Analytics: The Power to Predict Who Will Click, Buy, Lie, or Die, John Wiley & Sons, 2013.
2. Dirk Deroos et al., Hadoop for Dummies, Dreamtech Press, 2014.
3. I.H. Witten and E. Frank, Data Mining: Practical Machine learning tools and techniques.
4. P. Simon, Too Big to Ignore: The Business Case for Big Data; Wiley, 2015.

VII Semester

Department of Computer Science & Engineering

Course Code : CSP451-2 **Course : Web Intelligence and Big Data Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 01**

Course Objectives

1. To develop understanding about working of search engines and perform optimization for improving the search results.
2. To apply various techniques to perform tasks related to web intelligence.
3. Understand the Big Data, Platforms, analytic techniques and applications.
4. Perform analysis of Big data using suitable technique and use of different tools.

Experiment basedon syllabus of Web Intelligence and Big Data (CST451-2)

Course Outcomes

On Successful completion of this course, students will able to:

1. To implement intelligent web-based systems for solving a well-defined web intelligence problem using tools and techniques, by analyzing the data to extract insight from it.
2. To demonstrate the working of the recommender systems.
3. To perform big data analytics on structured and unstructured data, using various data analytic techniques.
4. To apply appropriate Machine Learning algorithms and big data techniques to address real-world problems.

References

1. Tom White; Hadoop: The Definitive Guide, 4th Edition, O'Reilly, 2015.
2. Hien Luu; Beginning Apache Spark 2: With Resilient Distributed Datasets, Spark SQL, Structured Streaming and Spark Machine Learning Library, Apress, 2018.
3. Bart Baesens, Analytics in a Big Data World : The Essential Guide to Data Science and its Applications, Wiley, 2014
4. H. Witten and E. Frank, Data Mining: Practical Machine learning tools and techniques.

VII Semester

Department of Computer Science & Engineering

Course Code : CST451-3 **Course : Data Visualization and Analytics**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Objectives

1. To understand data analytics life cycle for solving challenging business problems.
2. To adopt appropriate statistical procedures for analysis based on goals and nature of data.
3. To employ best practices in data visualization to develop charts, maps tables and other visual representations of data.

SYLLABUS

UNIT - I : Introduction and Overview

Importance of analytics and visualization, data preprocessing, Basic Analysis Techniques, Data Analytics Lifecycle and Different Phases

UNIT - II : Association Rules and Regression

Association Rules : Overview, Apriori Algorithm, Evaluation of Candidate Rules, Frequent Itemsets and Rule Generation, Validation and Testing, Diagnostics.

Regression: Linear Regression, Logistic Regression, Choice of a Model.

UNIT - III : Classification and Clustering

Clustering : Overview, k-Means, k-Modes, Partitioning around Medoids (PAM), Hierarchical Agglomerative and Density Clustering Methods. Classification: Decision Trees – Overview, Detecting Significant Split, Algorithms and Evaluation; Naïve-Bayes – Bayes' Theorem, Naïve Bayes Classifier, Smoothing; Diagnostics of Classifiers.

UNIT - IV : Time Series Analysis

Time Series Analysis : Box-Jenkins Methodology, ARIMA (Auto Regressive Integrated Moving Average) Model, Choice of a Model, Overview of ARMAX, Spectral Analysis and GARCH.

UNIT - V : Data Visualization

Understanding Data Visualization Principles, Mapping Data onto Aesthetics, Visualizing - Distributions, Proportions, Time Series, Trends and Uncertainty; Commonly used File Formats and Software.

UNIT - VI : Creating Stories with Data

Why Planning?, Creating Interesting Stories with Data – Reader-driven Narratives, Author-driven Narratives; Perceptions and Presentation Methods, Best Practices in Visualization, Interactive Visualization, Event Listeners and Layouts, Case Studies for Visualization.

Course Outcomes

On completion of the course the student will be able to

1. Apply data preprocessing and basic data analysis techniques.
2. Conduct data analytics using scientific methods.
3. Analyze time series data.
4. Create presentations and visualizations.

Text Books

1. David Dietrich, Barry Heller and Beibel Yang, - Data Science and Big Data Analytics – Discovering, Analyzing, Visualizing, and Presenting Data, John Wiley and Sons [EMC Education Services], 2015.
2. Claus O. Wilke, - Fundamentals of Data Visualization – A Primer on Making Informative and Compelling Figures, O'Reilly, 2019.
3. Python: Data Analytics and Visualization, Packt Publishing, 2017.

Reference Books

1. Jiawei Han, Micheline Kamber and Jian Pei, - Data Mining Concepts and Techniques, 3rd edition; Morgan Kaufmann Publishers, 2011.

VII Semester

Department of Computer Science & Engineering

Course Code : CSP451-3 **Course : Data Visualization and Analytics Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 01**

Course Objectives

1. To apply statistical methods for data analytics to provide business solutions.
2. To develop insights based on analytical results to facilitate better understanding of consumer attitude, perceptions and behavior.
3. To create data visualizations for effective communication to user.

Experiments based on CST451-3 Syllabus preferably using R, Python, JavaScript.

Course Outcomes

On completion of the course the student will be able to

1. Apply different data preparation techniques.
2. Apply various data analysis techniques.
3. Apply analytics on time series data.
4. Design effective presentations and visualizations.

Reference Books

1. David Dietrich, Barry Heller and Beibel Yang, - Data Science and Big Data Analytics – Discovering, Analyzing, Visualizing, and Presenting Data, John Wiley and Sons [EMC Education Services], 2015.
2. Kyran Dale, - Data Visualization with Python and JavaScript – Scrape, Clean and transform Your Data, O'Reilly, 2016.

VII Semester

Department of Computer Science & Engineering

Course Code : CST451-4 **Course : Fundamentals of Augmented Reality**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Pre-requisite

1. Programming Language (C/C++/Java)
2. Data Structures
3. Computer Graphics

Course Objectives

1. Identify and examine fundamental techniques for the design and deployment of Virtual and Augmented reality applications
2. Describe how Virtual and Augmented reality systems works.
3. Understand virtual world space and various modal used as input and output interface in virtual reality
4. Perform animation in virtual environment and physical simulation.
5. Choose, develop, explain, and defend the use of particular designs for augmented reality experiences.

Syllabus

UNIT - I : Introduction to Virtual Reality

Fundamental Concept and Components of Virtual Reality, Primary Features and Present Development on Virtual Reality, Computer graphics, Real time computer graphics, Flight Simulation, requirements of virtual environment, benefits of virtual reality, Hardware technologies for 3D user interface: Visual Displays Auditory Displays, Haptic Displays, Choosing Output Devices for 3D User Interfaces

UNIT - II : 3D Computer Graphics

The Virtual world space, the perspective projection, human vision, 3D clipping, Colour theory, Simple 3D modeling, Illumination models, Reflection models, Shading algorithms, Hidden Surface Removal

Multiple Modals of Input and Output Interface in Virtual Reality:

Input - Tracker, Sensor, Digital Glove, Movement Capture, Video-based Input, 3D Menus & 3DScanner
Output - Visual / Auditory / Haptic Devices

UNIT - III : Environment Modeling

Geometric Modeling, behavior simulation, from 2D to 3D, 3D space curves, 3D boundary representation Geometrical Transformations: Frames of reference, Modeling transformations, Instances, Picking, Flying, Scaling the VE, Collision detection Generic VR system: Introduction, Virtual environment, Computer environment, VR technology, Model of interaction, VR Systems.

UNIT - IV : Animating the Virtual Environment

Introduction, The dynamics of numbers, Linear and Nonlinear interpolation, the animation of objects, linear and non-linear translation, free from deformation, particle system

Physical Simulation

Introduction, Objects falling in a gravitational field, Rotating wheels, Elastic collisions, projectiles, simple pendulum, springs, Flight dynamics of an aircraft

UNIT - V : Augmented Reality

Introduction to Augmented reality technology, technology and features of augmented reality Augmented reality in everyday world, Types of augmented reality, The similarities and differences between AR and VR, Multimodal displays, Challenges with AR, AR systems and functionality, Augmented reality methods, visualization techniques for augmented reality

UNIT - VI : Augmented Reality Applications

Wireless displays in educational augmented reality applications, mobile projection interfaces, marker-less tracking for augmented reality, evaluating AR systems.

Course Outcomes

At the end of the course, the students will be able to:

1. Analyze architectures and input/ output devices of virtual reality systems
2. Perform environmental modeling in terms of geometric modeling and transformation
3. Develop virtual reality applications incorporating physical simulation for various real life scenarios
4. Evaluate various augmented reality applications.

Text Books

1. John Vince, -Virtual Reality Systems||, Pearson Education Asia, 2007.
2. Adams, -Visualizations of Virtual Reality||, Tata McGraw Hill, 2000
3. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
4. Alan B Craig, William R Sherman and Jeffrey D Will, - Developing Virtual Reality Applications: Foundations of Effective Design||, Morgan Kaufmann, 2009.

Reference Books

1. Anand R., - Augmented and Virtual Reality, Khanna Publishing House, Delhi.
2. Doug A Bowman, Ernest Kuijff, Joseph J LaViola, Jr and Ivan Poupyrev, - 3D User Interfaces, Theory and Practice, Addison Wesley, USA, 2005.
3. Burdea, Grigore C and Philippe Coiffet, - Virtual Reality Technology, Wiley Interscience, India, 2003.
4. Adams, - Visualizations of Virtual Reality, Tata McGraw Hill, 2000
5. Oliver Bimber and Ramesh Raskar, - Spatial Augmented Reality: Meging Real and VirtualWorlds, 2005.
6. Howard Rheingold, - Virtual Reality: The Revolutionary Technology and how it Promises to Transform Society, Simon and Schuster, 1991.

VII Semester

Department of Computer Science & Engineering

Course Code : CST451-4 **Course : Fundamentals of Augmented Reality Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 01**

Course Pre-requisite

1. Programming Language (C/C++/Java)
2. Data Structures
3. Computer Graphics

Course Objectives

1. Develop virtual augmented reality application for the real life scenarios.
2. Demonstrate 3D geometric modeling using augmented and virtual reality techniques.
3. Explore virtual world space in the context of virtual augmented and reality.

Lab Experiments (suggested)

1. Developing architecture of a house using Virtual Reality.
2. Perform CRO based experiment using Virtual Reality.
3. Undertaking qualitative analysis in Chemistry using Virtual Reality.
4. Carry out assembly/disassembly of an engine using Virtual Reality.
5. Explore human anatomy using augmented Reality.
6. Simulation of Fight/Vehicle/Space Station.
7. Building Electronic circuit using Virtual Reality, given basic electronic components using augmented reality
8. Developing concept of Virtual class room with multiplayer using augmented reality

Hardware Requirement

- (Required) USB Webcam
- Android cell phone or tablet

Software Requirement

- Unity 3D [Development platform for creating 2D and 3D multiplatform games and interactive experiences]

- Blender [Free and open source 3D creation suite. It supports the entirety of the 3D pipeline—modeling, rigging, animation, simulation, rendering, compositing and motion tracking, video editing and 2D animation pipeline]
- Fork [a fast and friendly git client for Mac and Windows]

Course Outcomes

1. Implement virtual reality application using Unity 3d software tools
2. Simulate3D geometric modeling by applying virtual and augmented reality techniques
3. Realize various real life applications using augmented reality tools.

Text Books

1. John Vince, - Virtual Reality Systems - , Pearson Education Asia, 2007.
2. Adams, - Visualizations of Virtual Reality||, Tata McGraw Hill, 2000.
3. Alan B. Craig, Understanding Augmented Reality, Concepts and Applications, Morgan Kaufmann, 2013.
4. Alan B Craig, William R Sherman and Jeffrey D Will, - Developing Virtual Reality Applications: Foundations of Effective Design||, Morgan Kaufmann, 2009.

VII Semester

Department of Computer Science & Engineering

Course Code : CST452-1 **Course : Digital Image and Video Processing**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Objectives

1. This course provides a brief view of basic enhancement techniques, different models and various algorithms used for digital image and video processing.

2. This course introduces the students with real time applications and its implementation using various techniques and algorithms.

Syllabus

UNIT - I

Introduction : Applications of Image Processing, Fundamental steps, Elements of visual perception, image sensing and acquisition, image sampling and quantization, basic relationships between pixels – neighborhood, adjacency, connectivity, distance measures and Mathematical operations, Introduction to color models.

UNIT - II

Spatial Domain Transformations : Basic Intensity transformation functions, Histogram processing, Spatial Correlation and Convolution, Smoothing filters, Sharpening filters.

UNIT - III

Frequency Domain Transformation : 2D Discrete Fourier Transform and its inverse, properties of DFT, Image Smoothing using Frequency Domain filters, Image Sharpening, Homomorphic filtering, Selective filtering

UNIT - IV

Morphological Image Processing : Erosion, Dilation, Opening, Closing, Hit or Miss Transformation, Boundary Extraction, Hole Filing, Extraction of Connected components, Convex Hull, Thinning, Thickening, Skelton and Pruning.

UNIT - V

Image Segmentation : Point, Line, edge detection, edge linking and boundary detection, thresholding – global and adaptive, region-based segmentation.

UNIT - VI

Introduction to Video Processing : Digital Videos, Sampling; Elements of a video coding; Video coding standards – MPEG and H.26X, Motion Estimation and compensation and Block matching.

Course Outcomes

On Successful completion of this course, will be able to

1. Analyze different image enhancement techniques.
2. Implement different morphological operations.
3. Apply image segmentation for image understanding.
4. Apply algorithms in image and video processing applications.

Text Books

1. R.C. Gonzalez and R.E. Woods, Digital Image Processing, Second Edition, Pearson Education 3rd edition 2008
2. Anil Kumar Jain, Fundamentals of Digital Image Processing, Prentice Hall of India. 2nd edition 2004
3. Murat Tekalp , Digital Video Processing" Prentice Hall, 2nd edition 2015

Reference Books

1. S Jayaraman, S Esakkirajan, Digital Image Processing, McGraw Hill Education.
2. Milan Sonka, Vaclav Hlavac and Roger Boyle, Image Processing Analysis and Machine Vision, Brooks, 1999

VII Semester

Department of Computer Science & Engineering

Course Code : CST452-1 **Course : Digital Image and Video Processing Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 01**

Course Objectives

1. This course gives the overall view of image and video processing techniques starting from basic arithmetic operations to complex video processing algorithms.
2. This course will introduce the students to working of real world applications and enhance the problem solving skills to solve the real world problems.

Syllabus

The instructor should design the practical such that the student should be able: To design and simulate the following exercises:

- Mathematical Operations on images
- Image Enhancement with Spatial filters
- Image Enhancement with Frequency Filters
- Morphological Operations on image
- Edge detection and linking
- Image Segmentation
- Working with color models
- Video Processing.

Course Outcomes

On Successful completion of this course, will be able to

1. Implement various image enhancement techniques.
2. Demonstrate different morphological operations.
3. Implement various methods of edge detection and image segmentation for extraction of Region of interest.
4. Apply various video processing techniques.

VII Semester

Department of Computer Science & Engineering

Course Code : CST452-2 **Course : Distributed and Parallel Database**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Prerequisite Courses

Distributed Systems CST359-2, Database Management Systems CST351

Course Objectives

1. Introduce basic principles of distributed database systems and storage management.
2. Provide techniques for distributed query optimization.
3. Develop ways of implementing distributed Transaction, concurrency control, backup and recovery techniques.
4. Understand Parallel database concepts and contemporary knowledge applications of distributed and parallel database

Syllabus

UNIT - I

Distributed data processing; What is a DDBS; Advantages and disadvantages of DDBS; Problem areas; Overview of database and computer network concepts, Architecture of Distributed Database, Client Server Systems

UNIT - II

Storage Management in Distributed Database, horizontal and vertical fragmentation, Data partitions and clusters

UNIT - III

Query optimization, computation of join costs and access costs, semijoins, Using Heuristics in Query optimization.

UNIT - IV

Transaction and concurrency control, two phase commit, implementation of ACID properties in parallel and distributed Database.

UNIT - V

Backup, and Recovery concepts, Transaction recovery, replication concepts, multimaster and snapshot Replication conflict resolution.

UNIT - VI

Database Servers, Architecture of Parallel Databases, Parallel DBMS techniques, and Parallel Execution problems, Applications of Distributed databases and parallel databases.

Course Outcomes

After successful completion of this course, the student should:

1. Analyze the design principles and concepts of various distributed architectures.
2. Ensure correctness of design principles and database concepts such as transactions, concurrency, recovery and reliability in the context of distributed database.
3. Implement distributed query processing and various heuristics in distributed query processing.
4. Analyze various Parallel database Architectures, Applications of distributed and parallel database.

Text books

1. S. Ceri and G. Pelagati; "Distributed Database Systems"; McGraw Hill, 2002 Reprint.
2. Tamer Ozstu; "Principles of Distributed Database Systems"; Prentice Hall, 1991.

Reference Books

1. D. Bell and J. Grimson; "Distributed Database Systems"; Addison-Wesley 1992.

VII Semester

Department of Computer Science & Engineering

Course Code : CSP452-2 **Course : Distributed and Parallel Database Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 01**

Course Objectives

1. Introduce basic principles and implementation techniques of distributed database systems.
2. Provide knowledge of distributed transaction processing.
3. Deliver methods for distributed query processing.
4. Provide methods for implementation of backup and recovery concepts

Practicals based on CST452-2 Syllabus.

Course Outcomes

After successful completion of this course, the student should be able to

1. Analyze various distributed database design principles
2. Implement distributed transaction processing
3. Implementation of distributed query processing
4. Use of backup and recovery concepts.

VII Semester

Department of Computer Science & Engineering

Course Code : CST452-3 **Course : Game Theory**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Objectives:

1. This course provides an introduction to Game Theory, a mathematical framework which makes possible the analysis of the decision making process of interdependent subjects.
2. The course aims at explaining and predicting how individuals behave in a specific strategic situation to improve decision making.

Syllabus

UNIT - I : Introduction to Game Theory

Game Theory Intro, Self-Interested Agents and Utility Theory, Defining Games, Examples of Games Theory of rational choice, Interacting decision makers

UNIT - II : Strategic Games and Nash Equilibrium

Strategic Reasoning, Strategic games: examples, Nash Equilibrium Intro, concept and examples, Best response functions, Nash Equilibrium of Example Games Dominant Strategies ,Dominated Actions, Symmetric games and symmetric equilibria

UNIT - III : Illustrations of Nash Equilibrium

Cournot's model of duopoly market, Bertrand's model of duopoly market, Electoral Competition, War of Attrition, Auctions, Accident Laws

UNIT - IV : Mixed Strategy Nash Equilibrium

Introduction, Strategic games with randomization, Mixed strategy Nash equilibrium: concept and examples, Computing Mixed Nash Equilibrium, Dominated Actions, Formation of Players' beliefs, Alternate solution concepts.

UNIT - V : Extensive Games and Nash Equilibrium

Introduction to extensive games, Strategies and outcomes, Subgame perfect Nash equilibrium, Backward induction

UNIT - VI : Advanced Topics

Repeated games, finite and infinite repeated games, stochastic games and learning, Bayesian Games: Definition, Analyzing Bayesian Games, Coalitional Game Theory: Definitions, The Shapley Value, The Core, Comparing the Core and Shapley value.

Course Outcomes

On successful completion of the course, students will be able to:

1. Distinguish a game as decision problem and understand concepts of players, strategies, payoffs, rationality, equilibrium.
2. Establish dominant strategy equilibrium, pure and mixed strategy Nash equilibrium.
3. Create sequential games using game trees, and to use the backward induction to designsolutions.
4. Analyze Repeated games and Bayesian Games.

Text Books

1. Osborne, M.J., An Introduction to Game Theory, Oxford University Press, 2004
2. Gibbons, R. A , Primer in Game Theory, Pearson Education, 1992
3. Fudenberg, Drew, and Jean Tirole, Game Theory. MIT Press, 1991. ISBN: 9780262061414.

Reference Books

1. Vijay Krishna, Auction Theory, Academic Press.
2. PrajitDutta, Strategies and Games, MIT Press
3. Mas-Colell, A., M.D. Whinston and J.R. Green Microeconomic Theory, Oxford University Press, 1995

VII Semester

Department of Computer Science & Engineering

Course Code : CST452-3 **Course : Game Theory Lab**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 01**

Course Objectives

1. Apply basic knowledge of Game Theory to improve strategic instincts and decision- making skills.
2. To illustrate standard equilibrium concepts using, real-world examples, case studies, and lab experiments

Syllabus

Experiment based on syllabus of Game Theory (CST452-3).

Course Outcomes

1. Identify strategic situations to represent them as games.
2. Implement strategies to solve simple games.
3. Apply standard equilibrium concepts like Nash Equilibrium and others to analyze and stimulate real world examples.
4. Use backward induction to implement sequential games using game trees.

VII Semester

Department of Computer Science & Engineering

Course Code : CST452-4 **Course : Cloud Computing**

L: 3Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 03**

Pre-requisites

CST255 - Operating Systems, CST353 - Computer Networks

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Cloud computing and develop skills required to design real-life cloud based projects by:

1. Learning basics of cloud and challenges in implementation.
2. Identifying areas where cloud computing can be applied.
3. Understanding the cloud environment and its security issues.
4. Understanding the various cloud programming and software environments.

Syllabus

UNIT - I

Introduction: Evolution of Cloud Computing –Underlying Principles of Parallel and Distributed Computing, Cloud Fundamentals: Cloud Definition, Evolution, Architecture, Cloud Characteristics – Elasticity in Cloud – On-demand Provisioning, Applications, deployment models - Public, Private and Hybrid Clouds, and service models - Infrastructure as a Service (IaaS) - Resource Virtualization: Server, Storage,Network. Platform as a Service (PaaS) - Cloud platform & Management : Computation, Storage. Software as a Service (SaaS) - Anything as a service (XaaS).

UNIT - II

Virtualization: Definition, Understanding and Benefits of Virtualization. Implementation Level of Virtualization, Virtualization Structure / Tools and Mechanisms, Issues with virtualization, virtualization technologies and architectures, Internals of virtual machine monitors / hypervisors, introduction to Various Hypervisors, virtualization of data centers, and Issues with Multi-tenancy.

UNIT - III

Resource Management and Load Balancing : Distributed Management of Virtual Infrastructures, Server consolidation, Dynamic provisioning and resource management, Resource Optimization, Resource dynamic reconfiguration, Scheduling Techniques for Advance Reservation, Capacity Management to meet SLA Requirements, and Load Balancing, various load balancing techniques.

UNIT - IV

Interoperability, Migration and Fault Tolerance : Issues with interoperability, Vendor lock-in, Interoperability approaches, Broad Aspects of Migration into Cloud, Migration of virtual Machines and techniques. Fault Tolerance Mechanisms.

UNIT - V

Security : Vulnerability Issues and Security Threats, Application-level Security, Data level Security, and Virtual Machine level Security, Infrastructure Security, and Multi- tenancy Issues.

UNIT - VI

Cloud Programming and Software Environments : Parallel and Distributed Programming paradigms – Programming on Amazon AWS and Microsoft Azure – Programming support of Google App Engine and Microsoft Azure, Build Private / Hybrid Cloud using open source tools, Deployment of Web Services from Inside and Outside a Cloud Architecture.

Course Outcomes

On successful completion of the course, the student will be able to:

1. Articulate the concepts of cloud computing, its various deployment and service models.
2. Implement the concept of virtualization and resource management.
3. Demonstrate the measures to be taken for handling fault tolerance and security.
4. Provide cloud computing solutions and recommendations for cloud programming and software environments based applications.

Text Books

1. Kai Hwang, Geoffrey C. Fox and Jack J. Dongarra, - Distributed and cloud computing from Parallel Processing to the Internet of Things, Morgan Kaufmann, Elsevier – 2012
2. Cloud Computing Principles and Paradigm, Rajkumar Buyya, James Broberg, AndrzejGoscinski, Wiley Publishers.2011

Reference Books

1. Barrie Sosinsky, - Cloud Computing Bible|| John Wiley & Sons, 2010
2. Tim Mather, Subra Kumaraswamy, and Shahed Latif, - Cloud Security and Privacy An Enterprise Perspective on Risks and Compliance, O'Reilly 2009
3. Cloud Computing : A Practical Approach, Toby Velte, Anthony TVelte, Robert Elsenpeter, McGraw Hill,2009

VII Semester

Department of Computer Science & Engineering

Course Code : CSP452-4 **Course : Cloud Computing Lab**

L: 3Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 01**

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Cloud computing and develop skills required to build real-life cloud based projects by:

1. Studying various cloud environments.
2. Implementing various cloud programming concepts.
3. Designing and developing processes involved in creation of a cloud based application.

Practicals based on CST452-4 syllabus.

Course Outcomes

On completion of this course, the students will be able to:

1. Configure various virtualization tools.
2. Design an application in a cloud environment.
3. Demonstrate the use of cloud environment to access cloud storage.
4. Implement concepts of migration and load balancing.

VII Semester

Department of Computer Science & Engineering

Course Code : ITD451 **Course : Bio-Informatic**

L: 2Hrs, T: 1Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Objectives

1. Provide an introduction to the field of Bioinformatics.
2. Describe how bioinformatics data is stored and organized.
3. Provide an approach to build search query and sequence alignment.
4. Provide methods for genome analysis.

Syllabus

UNIT - I

Introduction to Biological Data Acquisition : Genome Sequences ORFs, Genes, Introns, Exons, Splice Variants DNA/RNA Secondary Structure, Retrieval methods for DNA sequence, protein sequence and protein structure information

UNIT - II

Databases – Format and Annotation : Conventions for database indexing and specification of search terms, Common sequence file formats. Annotated sequence databases - primary sequence databases, protein sequence and structure databases; Organism specific databases

UNIT - III

Data – Access, Retrieval and Submission: Standard search engines, Data retrieval tools – Entrez, DBGET and SRS, Submission of (new and revised) data

UNIT - IV

Sequence Information Sources : EMBL GENBANK Entrez Unigene Understanding the structure of each source and using it on the web, Sequence Similarity Searches: Local versus global, Distance metrics, Similarity and homology, scoring matrices.

UNIT - V

Dynamic programming algorithms : Needleman-wunsch and Smith-waterman, Heuristic Methods of sequence alignment, FASTA, BLAST and PSI BLAST. Multiple Sequence Alignment and software tools for pair wise and multiple sequence alignment.

UNIT - VI

Genome Analysis : Whole genome analysis, existing software tools, Genome Annotation and Gene Prediction, ORF finding, Phylogenetic Analysis, Comparative genomics, orthologs, paralogs, Methods of phylogenetic analysis, UPGMA, WPGMA, neighbour joining method, Fitch/Margoliash method, Character Based Methods.

Course Outcomes

On successful completion of the course, the student will be able to:

1. Understand the basics of Biological Data acquisition.
2. Implement format , access and retrieval of Biological data.
3. Identify sequence structure , alignment and search query.
4. Use visualization tools and perform genome analysis.

Textbooks

1. Bioinformatics: Databases and Systems, by Stanley I. Letovsky
2. Bioinformatics Databases : Design, Implementation, and Usage (Chapman & Hall / CRC Mathematical Biology & Medicine), by Sorin Draghici
3. Data base annotation in molecular biology, principles and practices, Arthur M.Lesk
4. Current topics in computational molecular biology, Tao, Jiang, Ying Xu, Michael Q.Zang

Reference Books

1. D. Baxevanis and F. Oulette, (2002) - Bioinformatics : A practical guide to the analysis of genes and proteins||, Wiley Indian Edition
2. Cynthia Gibas and Per Jambeck (2001), - Developing Bioinformatics Computer Skills||. O'Reilly press, Shorff Publishers and Distributors Pvt. Ltd., Mumbai.
3. Bryan Bergeron MD (2003), - Bioinformatics Computing||. Prentice Hall India (EconomyEdition)

VII Semester

Department of Computer Science & Engineering

Course Code : CSP454 **Course : Project - 2**

L: 0Hrs, T: 0Hr, P: 12Hr, Per Week **Total Credits : 06**

Course Outcomes

On completion of this course the student will be able to

1. Undertake problem identification, formulation, and analysis of project statement by investigating various domains and society needs.
2. Perform requirement analysis and design methodology for solving the identified problem.
3. Apply advanced programming techniques and modern tools for the design and development of a solution.
4. Demonstrate ethical principles, project management skills and team work.
5. Communicate technical information employing written reports and presentations.

Scope

Students are expected to approach to solving a real-world problem in providing effective and efficient software solution through team effort.

VII Semester

Department of Computer Science & Engineering

Course Code : CSP455 **Course : Industry Internship Evaluation**

L: 0Hrs, T: 0Hr, P: 2Hr, Per Week **Total Credits : 00**

Course Objectives

1. To enable students in exploring opportunities for alternative career development.
2. To assess interests and abilities in the respective field of stud and to integrate theory and practice.
3. To learn workplaces habits and develop attitudes and skills necessary for job success.

Scope

Students are expected complete the internship before the start of VII semester. Industry internship evaluation will be carried out during the VII Semester.

Mode of Conduction

Each student will be evaluated through Seminar-cum-Presentations on following parameters

- Technology
- Domain Understanding
- Outcomes

Course Outcomes

On completion of the course the student will be able to

1. Demonstrate work ethics and procedures.
2. Communicate effectively with peer teams and superiors at work.
3. Demonstrate the proficiency in interpersonal and critical skills required for career growth.

VIII Semester

Department of Computer Science & Engineering

Course Code : CST456-1 **Course : Neural Network and Deep Learning**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Objectives

1. To understand various neural networks techniques
2. To Introduce major deep learning (DL) algorithms
3. To understand the concepts in problem settings
4. To understand DL algorithm applications to solve real world problems.

Syllabus

UNIT - I

Introduction : Perspectives and Issues in deep learning framework, review of fundamental learning techniques.

Feed forward neural network : Artificial Neural Network, activation function, multi- layer neural network

UNIT - II

Training Neural Network : Risk minimization, loss function, backpropagation, regularization, drop out, model selection, and optimization.

UNIT - III

Conditional Random Fields : Linear chain, partition function, Markov network, Belief propagation, Hidden Markov Model, Entropy.

UNIT - IV

Deep Learning : Deep Feed Forward network, regularizations, training deep models, Convolutional Neural Network, Recurrent Neural Network.

UNIT - V

Probabilistic Neural Network : Hopfield Net, Boltzman machine, Sigmoid net, Autoencoders.

UNIT - VI

Deep Learning Research : Object recognition, sparse coding, computer vision, natural language processing.

Deep Learning Tools: Caffe, Theano, Torch.

Course Outcomes

On successful completion of the course, students will be able to:

1. Analysis neural network for different technique.
2. Apply appropriate deep learning algorithm to realize various learning problem.
3. Design appropriate deep learning algorithms to various data sets.
4. Apply deep learning algorithms to solve real world problems.

Text Books

1. Goodfellow, I., Bengio,Y., and Courville, A., Deep Learning, MIT Press, 2016..
2. Bishop, C. ,M., Pattern Recognition and Machine Learning, Springer, 2006.

Reference Books

1. Yegnanarayana, B., Artificial Neural Networks PHI Learning Pvt. Ltd, 2009.
2. Golub, G.,H., and Van Loan,C.,F., Matrix Computations, JHU Press,2013.
3. Satish Kumar, Neural Networks: A Classroom Approach, Tata McGraw-Hill Education, 2004.

Books on Optimization Techniques

1. A. Ravindran, K. M. Ragsdell , and G. V. Reklaitis, Engineering Optimization: Methods and Applications , John Wiley & Sons, Inc. , 2016.
2. A. Antoniou, W. S. Lu, Practical Optimization Algorithms and Engineering Applications, Springer, 2007.

VIII Semester

Department of Computer Science & Engineering

Course Code : CST456-2 **Course : Robotics - Perception and Estimation**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Objectives

1. To study the brief introduction to Robotics.
2. To study the use of various types of robot simulation and Sensors.
3. To impart knowledge in Robot Kinematics and Programming
4. To understand robot navigation and its application development.

Syllabus

UNIT - I : INTRODUCTION

History of service robotics, Present status and future trends, Need for service robots, applications, examples and Specifications of service and field Robots, Non- conventional Industrial robots.

Basic terminology- Accuracy, Repeatability, Resolution, Degree of freedom, Kinematics systems, Definition of mechanisms and manipulators, Mechanisms and transmission, End effectors, Grippers- different methods of gripping.

UNIT - II : ROBOT SIMULATION

Drive system- hydraulic, pneumatic and electric systems Mathematical modeling of the robot, Robot kinematics, Concepts of ROS and Gazebo.

UNIT - III : ROBOTIC SENSORS

Working with the ultrasonic distance sensors, Working with the IR proximity sensor, Working with Inertial Measurement Unit.

Introduction to Cameras, Camera calibration, Geometry of Image formation, Euclidean / Similarity / Affine / Projective transformations, Vision applications in robotics and vision sensors.

UNIT - IV : ROBOTS PROGRAMMING

Programming of robots using NXT software, Robot C and Labview programming - Line follower, Obstacle avoidance robot, Wall following robot, Robotic arm and other simple applications.

UNIT - V : MAP BUILDING [Application Development]

Introduction, Constructing a 2D World Map, Data Structure for Map Building, Explanation of the Algorithm, An Illustration of Procedure Traverse Boundary, An Illustration of Procedure Map Building, Robot Simulation, Execution of the Map Building Program.

UNIT - VI : PLANNING AND NAVIGATION [Application Development]

Introduction, Path planning overview, Global path planning: A* Algorithm, Local path planning, Road map path planning, Cell decomposition path planning , Potential field path planning , Obstacle avoidance, Path control, Robotics and Automation for Industry 4.0, Safety Considerations for Robot Operations

Course Outcome

On successful completion of the course, students will be able to:

1. Apply the theoretical understanding of Robotics.
2. Demonstrate working principles of robotic Simulation and Sensors.
3. Create programs for cognitive robotic applications.
4. Demonstrate path planning and navigation over MAP's.

Text Books

1. Patnaik, Srikanta, "Robot Cognition and Navigation - An Experiment with Mobile Robots", Springer- Verlag Berlin and Heidelberg,2007
2. Aaron Martinez and Enrique Fernandez, - Learning ROS for Robotics Programming||, PACKT Publishing, 2013
3. David MacKay, - Information Theory, Inference and Learning Algorithms||, Cambridge, 2003
4. J J Craig, -Introduction to Robotics: Mechanics and Control||, Prentice Hall, 2004.
5. Mikell P Groover, Nicholas G Odrey, Mitchel Weiss, Roger N Nagel, Ashish Dutta, - Industrial Robotics, Technology programming and Applications", McGraw Hill, 2012

Reference Books

1. David Jefferis, - Artificial Intelligence: Robotics and Machine Evolution||, Crabtree Publishing Company.
2. Sebastian Thrun, Wolfram Burgard, Dieter Fox, - Probabilistic Robotics||, MIT Press, 2005
3. Robin R. Murphy, - Introduction to AI Robotics||, A Bradford Book, MIT Press, 2000.
4. Bruno Siciliano, Oussama Khatib, - Springer Handbook of Robotics||, Springer Science and Business, 2010.

VIII Semester

Department of Computer Science & Engineering

Course Code : CST456-3 **Course : Multi Agent Intelligent Systems**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Objectives

1. Understand the basics of agent based intelligent systems.
2. Understand the role of knowledge and inference in agent based intelligent systems.
3. Understand the basics and working of multi-agent intelligent systems.

Syllabus

UNIT - I

Introduction : Agency, intelligence and learning, Intelligent Agents, Agents and Objects, Agents and Expert Systems, Agents as Intentional Systems, Abstract Architectures for Intelligent Agents, classification of multi agent systems

UNIT - II

Deductive Reasoning Agents : Agents as Theorem Provers, Agent - Oriented Programming, Concurrent Metate M, Applications.

UNIT - III

Practical Reasoning Agents : Deliberation, Means - Ends Reasoning, Implementing a Practical Reasoning Agent, the Procedural Reasoning System.

UNIT - IV

Reactive and Hybrid Agents : Reactive Agents, Cognitive Agents, The Subsumption Architecture, Situated automata, The Agent Network Architecture, The Limitations of Reactive Agents, Hybrid Agents.

UNIT - V

Ontologies, Ontology Languages, XML - Ad Hoc Ontologies, OWL -The Web Ontology Language, **Understanding Each Other :** Ontology Fundamentals, Ontology Building Blocks, an Ontology of KIF - Ontologies in First - Order Logic, RDF, Constructing an Ontology, Software Tools for Ontologies.

UNIT - VI

Multiagent Interactions : Utilities and Preferences, Setting the Scene, Solution Concepts and Solution Properties, Dominant Strategies, Nash Equilibria, Pareto Efficiency, Maximising Social Welfare, Competitive and Zero -Sum Interactions, The Prisoner's Dilemma, The shadow of the future, Program Equilibria, Other Symmetric 2x2 Interactions, Representing Multiagent Scenarios, Dependence Relations in Multiagent Systems.

Course Outcomes

On completion of the course the student will be able to

1. Apply concepts of intelligent agents to problems in agent based intelligent systems
2. Apply concepts of knowledge representation and inference to problems in agent based intelligent systems
3. Apply concepts of multi-agent systems to solve problems in agent based intelligent systems

Text Books

1. An Introduction to MultiAgent Systems -Second Edition, Michael Wooldridge, John Wiley &Sons 2009.
2. Reinforcement Learning: An Introduction, Richard S. Sutton and Andrew G. Barto, 2nd edition (in progress) 2017. On-line version.

References

1. Reinforcement Learning : An Introduction, Richard S. Sutton and Andrew G. Barto, MIT Press, 1998.
2. Parasumanna Gokulan, Balaji & Srinivasan, D.(2010). An Introduction to Multi- Agent Systems. 10.1007/978-3-642-14435-6_1.

VIII Semester

Department of Computer Science & Engineering

Course Code : CST456-4 **Course : Cryptography and Network Security**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Objectives

This course will provide students with a practical and theoretical knowledge of cryptography and network security. By the end of the course, students should be able to:

1. To build strong fundamental of cryptographic techniques and algorithm to realize Security Goals.
2. Understand authentication, access control, intrusion detection and prevention.
3. Identify and mitigate software security vulnerabilities in existing systems.

Syllabus

UNIT - I : Introduction to Cryptography

Security Threats, Vulnerability, Active and Passive attacks, Security services and mechanism, Conventional Encryption Model, Classical Cryptosystem, Classical Cryptographic Techniques.

UNIT - II : Symmetry key Cryptography

Block Cipher. Data Encryption Standard (DES), Modes of Operation, Stream Cipher. Advanced Encryption Standard (AES).

UNIT - III : Public key Cryptography

Mathematical background, Abstract algebra, Number Theory. Modular Inverse, Extended Euclid Algorithm, Fermat's Little Theorem, Euler Phi-Function, Euler's theorem. RSA Algorithm, Side-channel attack, Key Management, Diffie- Hellman Key Exchange, Elliptic Curve Cryptography.

UNIT - IV : Message Authentication and Integrity

Authentication requirement – Authentication function – MAC – Hash function – Security of hashfunction and MAC – SHA – Digital signature and authentication protocols – DSS- Entity Authentication: Biometrics, Passwords, Challenge Response protocols- Authentication applications
– Kerberos, X.509.

UNIT - V : Network Security Practices

Electronic Mail Security – PGP, – IP security – Web Security – The Secure Sockets Layer (SSL), SET.

UNIT - VI : System Security

Intruders – Trusted system – viruses – Firewalls. Introduction to Quantum Cryptography and Blockchain.

Course Outcomes:

On completion of the course the student will be able to

1. Analyze the Network Security Threats.
2. Apply cryptographic techniques and algorithm to build security related applications.
3. Solve problems related to key generation and key exchange algorithms.
4. Implement necessary Security mechanism to secure Computer Network.

Text Books

1. William Stallings; Cryptography & Networks Security Principles and Practice; 6th Edition Pearson Education, 2013.
2. Atul Kahate; Cryptography and Network Security; 1st Edition; Tata McGraw Hill, 2008.
3. Behrouz A. Forouzan, Cryptography and network security MC Graw Hill 3rd Edition

Reference Books

1. Modern Cryptography: Theory and Practice, by Wenbo Mao, Prentice Hall PTR
2. Network Security Essentials: Applications and Standards, by William Stallings. Prentice Hall
3. Cryptography: Theory and Practice by Douglas R. Stinson, CRC press.

VIII Semester

Department of Computer Science & Engineering

Course Code : CST457-1 **Course : Information Retrieval**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Objectives

The objective of the course is to prepare the students:

1. To learn fundamentals of information retrieval, indexing, relevance, classification, organization, storage and browsing.
2. To focus on prominent computer algorithms and methods used in information retrieval from a computer scientist's perspectives.

Syllabus

UNIT - I

Boolean retrieval, term vocabulary and postings lists, dictionaries and tolerant retrieval, index construction, index compression.

UNIT - II

Scoring, term weighting and the vector space model computing scores in a complete search system.

UNIT - III

Evaluation in information retrieval, relevance feedback and query expansion.

UNIT - IV

Probabilistic information retrieval, language models for information retrieval.

UNIT - V

Text classification and Naive Bayes, Vector space classification, Support vector machines and machine learning on documents.

UNIT - VI

Web search basics, Web crawling and indexes, Link analysis.

Course Outcomes

On successful completion of the course, students will be able to:

1. Analyze various requirements in designing an information retrieval system.
2. Apply methods of metadata organization for effective information access.
3. Implement Machine learning and numerical methods in information retrieval.

4. Evaluate information retrieval Systems
5. Design web search system.

Text and Reference Books

1. An Introduction to Information Retrieval : Christopher D. Manning, Prabhakar Raghavan,Hinrich Schütze, Cambridge University Press.
2. Foundation of Statistical Natural Language Processing, Christopher D. Manning, Hinrich Schütze, The MIT Press.
3. Information Retrieval: Implementing and Evaluating Search Engines, Stefan Buttcher, Charles L. A. Clarke, Gordon V. Cormack, MIT Press.

VIII Semester

Department of Computer Science & Engineering

Course Code : CST457-2 **Course : Natural Language Processing**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Objectives

1. To introduce students to the basic mathematical models and methods used in NLP applications.
2. To provide students with in-depth understanding on designing procedures for natural language resource annotation and the use of tools for text analysis.
3. To encourage students towards research in information retrieval, information extraction and knowledge discovery.

Syllabus

UNIT - I : Introduction

NLP tasks in syntax, semantics, and pragmatics. Key issues & Applications such as information extraction, question answering, and machine translation. The problem of ambiguity. The role of machine learning. Brief history of the field.

UNIT - II : N-gram Language Models

Role of language models. Simple N-gram models. Estimating parameters and smoothing. Evaluating language models. Part Of Speech Tagging and Sequence Labeling Lexical syntax. Hidden Markov Models. Maximum Entropy models.

UNIT - III : Syntactic parsing

Grammar formalisms and tree banks. Efficient parsing for context-free grammars (CFGs). Statistical parsing and probabilistic CFGs (PCFGs). Lexicalized PCFGs.

UNIT - IV : Semantic Analysis

Lexical semantics and word-sense disambiguation. Compositional semantics. Semantic Role Labeling and Semantic Parsing.

UNIT - V : Information Extraction (IE)

Named entity recognition and relation extraction. IE using sequence labeling. Automatic summarization Subjectivity and sentiment analysis.

UNIT - VI : Machine Translation (MT)

Basic issues in MT. Statistical translation, word alignment, phrase-based translation, and synchronous grammars.

Course Outcomes:

On successful completion of the course, students will be able to:

1. Implement methods for morphological analysis and POS tagging and systemevaluation methods.
2. Design formal grammars for NLP.
3. Implement important parsing algorithms.
4. Implement information extraction, NER & perform sentiment analysis for accurate MT process.

Textbook

1. D. Jurafsky and R. Martin; Speech and Language Processing; 2nd edition, Pearson Education, 2009.
2. Allen and James; Natural Language Understanding; Second Edition, Benjamin/Cumming, 1995.
3. Charniack & Eugene, Statistical Language Learning, MIT Press, 1993.

Reference Book

1. Akshar Bharati, Vineet Chaitanya, and Rajeev Sangal; NLP: A Paninian Perspective, Prentice Hall, New Delhi, 1994.
2. T. Winograd; Language as a Cognitive Process; Addison-Wesley, 1983.

VIII Semester

Department of Computer Science & Engineering

Course Code : CST457-3 **Course : Data Warehousing for Business Intelligence**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Course Pre-requisite

1. Database Management Systems [CST351]

Course Objectives

1. To understand data warehouse concepts and conduct dimensioning modeling in building data warehouses
2. To study the basics of data integration and ETL technology
3. To know business intelligence architecture and technologies
4. To study enterprise reporting
5. To know future trends in BI

Syllabus

UNIT - I : Introduction to Business Intelligence and Data Warehousing :

Business Intelligence Introduction – Definition, Leveraging Data and knowledge for BI, BI Components, BI Dimensions, Information Hierarchy, Business Intelligence and Business Analytics. BI Life Cycle.

Role of Data Warehousing in BI, data warehousing building blocks, Metadata in the data warehouse

UNIT - II : Principles of Dimensional Modelling :

Foundation for Fact based Decision Making, Star and Snowflake schema, pros & cons of the Star / Snowflake schema Dimensional Model, Slowly Changing Dimension tables, Fact-less Fact Tables, Aggregation Strategy, Time Dimension.

UNIT - III : Date Integration and ETL

Basics of Data Integration: Concepts of data integration need and advantages of using data integration, introduction to common data integration approaches, data integration technologies, Introduction to data quality, data profiling concepts and applications. Extraction, Transformation, and Load.

UNIT - IV : BI Architecture and Implementation

Key Drivers, Key Performance Indicators and operational metrics, BI Architecture/ Framework, Best Practices, Business Decision Making Advanced BI – Big Data and BI, Social Networks, Mobile BI, emerging trends.

UNIT - V : Enterprise Reporting :

Introduction to business metrics and KPIs, Basics of Enterprise Reporting: Introduction to enterprise reporting, concepts of dashboards, balanced scorecards, Business Activity Monitoring, Six Sigma.

UNIT - VI : Big Data and Future Directions for Business Analytics:

Fundamentals of Big Data Analytics, Big Data Technologies, Data Scientist, Big Data and Data Warehousing, Big Data and Stream Analytics, Applications of Stream Analytics.

Course Outcomes

At the end of the course, the students should be able to:

1. Apply the concepts of data warehousing
2. Use appropriate BI methods to find solutions to business problems
3. Create appropriate visualizations for the given business problem
4. Demonstrate application of big data in business analytics

Text Books

1. Business Intelligence: A Managerial Perspective on Analytics, 3rd Edition, Ramesh Sharda, Dursun Delen, Efaim Turban, Prentice Hall 2013.
2. Fundamentals of Business Analytics, R N Prasad and S Acharya, Wiley India.
3. Paulraj Ponnian, - Data Warehousing Fundamentals||, John Willey

Reference Books

1. Building the Data Warehouse, William H Inmon, John Wiley & Sons Inc, 2005
2. Adelchi Azzalini, Bruno Scapa, - Data Analysis and Data mining||, 2nd Edition, Oxford University Press Inc., 2012
3. Alex Berson and Stephen J. Smith, - Data Warehousing, Data Mining & OLAP||, 10th Edition, TataMc Graw Hill Edition, 2007.

VIII Semester

Department of Computer Science & Engineering

Course Code : CST457-4 **Course : Internet of Things**

L: 3Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 03**

Pre-requisites

CST353 - Computer Networks

Course Objectives

The objective of this course is to impart necessary and practical knowledge of components of Internet of Things and develop skills required to build real-life IoT based projects by:

1. Learning basic issues, policy and challenges in the Internet of Things.
2. Understanding application areas where Internet of Things can be applied.
3. Understanding the cloud and internet environment.
4. Understanding the various modes of communications with Internet.

Syllabus

UNIT - I

Introduction to IoT: Definition, Characteristics, Physical design, Logical design, Functional blocks, Components in internet of things, Sensors and Actuators, M2M and IoT Technology Fundamentals- Devices and gateways, Challenges in IoT: Design challenges, Development challenges, Security challenges, other challenges.

UNIT - II

Message Queue Telemetry Transport(MQTT), XMPP, Advanced Message Queuing Protocol (AMQP), Connectivity Technologies & Communication Protocols(Physical and Link Layer)-IEEE 802.15.4, BAN, Zigbee, 6LoWPAN, Bluetooth, RFID, HART, Network layer- IP/ IPv6, Transport Layer- UDP, TCP, Application Layer- Constrained Application Protocol(CoAP), HTTP.

UNIT - III

Basics of Networking : IoT network configurations, Network & Communication : Wireless medium access issues, MAC protocol survey, Survey routing protocols. Sensor Networks : Wireless sensor networks, sensor nodes, its components, single source object detection, single source multiple object detection, multiple source multiple object detection, node behavior, applications

UNIT - IV

Resource Management in the Internet of Things : Clustering, Software Agents, Data Synchronization, Clustering Principles in an Internet of Things Architecture, The Role of Context, Design Guidelines, Software Agents for Object, Role of Data Synchronization.

UNIT - V

Interoperability in IoT, Cloud in IoT, Iot to Web of Things, Cloud of Things, Introduction to different IoT tools, developing applications through IoT tools, Developing sensor based application through embedded system platform, Use of Big Data and Visualization in IoT Industry 4.0 concepts.

UNIT - VI

Unmanned aerial vehicle (UAV), Industrial Internet of Things Case Study: Home automation, Industry applications, Surveillance applications, Other IoT Applications, Smart Agriculture, Smart Energy, Health, Smart Home, Smart Cities, Connected vehicles, etc.

Course Outcomes

On successful completion of the course, the student will be able to:

1. Articulate the concept in Internet of Things and various sensor technologies for sensing real world entities.
2. Analyze various protocols of IoT and network configuration.
3. Demonstration of uploading downloading sensor data on cloud and server.
4. Design IoT applications in different domains.

Text Books

1. Honbo Zhou, - The Internet of Things in the Cloud: A Middleware Perspective, CRC Press-2012.
2. Dieter Uckelmann, Mark Harrison, - Architecting the Internet of Things, Springer2011.
3. Arshdeep Bahga, Vijay Madisetti, - Internet of Things (A Hands-On-Approach), VPT, 2014.
4. Olivier Hersent, David Boswarthick, Omar Elloumi, - The Internet of Things - Key applications and Protocols||, Wiley, 2012.

Reference Books

1. Waltenegus Dargie,Christian Poellabauer, "Fundamentals of Wireless Sensor Networks: Theory and Practice"
2. Charalampos Doukas, Building Internet of Things with the Arduino, Create space, April 2002.
3. Luigi Atzori, Antonio Lera, Giacomo Morabito, - The Internet of Things: A Survey||, Journal on Networks, Elsevier Publications, October, 2010.

VIII Semester

Department of Computer Science & Engineering

Course Code : CSP458 **Course : Project - 3 / Industry**

L: 0Hrs, T: 0Hr, P: 12Hr, Per Week **Total Credits : 06**

Course Outcomes

On completion of this course the student will be able to

1. Undertake problem identification, formulation, and analysis of project statement by investigating various domains and society needs.
2. Perform requirement analysis and design methodology for solving the identified problem.
3. Apply advanced programming techniques and modern tools for the design and development of a solution.
4. Demonstrate ethical principles, project management skills and team work.
5. Communicate technical information employing written reports and presentations.

Scope

Students are expected to approach to solving a real-world problem in providing effective and efficient software solution through team effort.

IV Semester (Honors Scheme)

Department of Computer Science & Engineering

Course Code : CSTH41 **Course : Programming for Advanced Computing**

L: 4Hrs, T: 0Hr, P: 0Hr, Per Week **Total Credits : 04**

Course Objectives

1. To familiarize the students with interdisciplinary fields like IoT.
2. To introduce students with embedded programming languages

Unit - I

Fundamentals of ARM Microprocessor : History of ARM, SoC with ARM core, ARM Bus technology, Memory management, Peripherals, Controllers, Processor Modes, Register Organization, Conditional Flags, Pipelining, Exceptions and Interrupts.

Unit - II

ARM instruction Set : Feature of ARM instruction Set, Data Processing Instructions, Data Transfer instruction, Flow control, Addressing Modes, Arithmetic Instructions, Logical Instructions, Comparison instruction, Stack Operations, Software Interrupt Instruction , Loading Constants, Thumb State, Exception/Interrupt return instruction, coprocessors.

Unit - III

Introduction of Raspberry Pi : History of Raspberry Pi, Features , Various Models of Raspberry Pi, Kit components, CPU Overview, Technical Specification of all components, Setup steps, Operating System, Peripherals, GPIO connectors, Interfacing of Sensors and Actuators, Remote login using Secure Shell (ssh) and Desktop Sharing using Virtual Network Computing (VNC).

Unit - IV

Linux Essential : Installation of Raspbian, Basic Commands, Interacting with Raspbian GUI and command line Interface, Linux Scripting

Unit - V

Programming with Raspberry Pi : C Programming and Python programming with Raspberry Pi

Unit - VI

Raspberry Pi Project Case Study

Course Outcomes

On successful completion of the course, students will be able to:

1. Analyze ARM Microprocessor architecture and instruction sets.
2. Implement Linux essentials required for Raspberry Pi.
3. Create simple systems using Raspberry Pi.
4. Realize small components using embedded programming languages.

Text Books

1. ARM System Developer's Guide Designing and Optimizing System Software by Andrew N. Sloss, Dominic Symes, Chris Wright , Morgan Kaufmann publishers
2. THE OFFICIAL Raspberry Pi Beginner's Guide by Gareth Half acree Rasberry Pi Publisher.
3. Raspberry Pi Cookbook by Simon Monk by Oreilly publishers

V Semester (Honors Scheme)

Department of Computer Science & Engineering

Course Code : CSTH51 **Course : Fundamentals of AWS Cloud**

L: 4Hrs, T: 0Hr Per Week **Total Credits : 04**

Course Objectives

The objective of this course is to familiarize the prospective engineers with:

1. To understand Cloud Computing Service and Deployment models.
2. To understand AWS Global Infrastructure.
3. To understand Security Management Services in AWS.
4. To understand Storage Services in AWS.
5. To understand Computing Services in AWS.
6. To understand Database and Networking Services in AWS.

Syllabus

Unit - I : Introduction to Cloud and AWS.

Classic Data Center, Virtualization, Cloud and Cloud Computing, Cloud Computing Service Models, Cloud Computing Deployment Models, Service Comparison: AWS, Azure, and GCP, Amazon WebServices (AWS) and its Benefits, AWS Global Infrastructure, AWS Regions and Replication of data between the Regions, Availability Zones and High Availability, AWS Edge Location, Different Amazon Web Services.

Unit - II : Security Management

User management through Identity Access Management (IAM), various access policies across AWS, Services Security Token Services AWS, Resource Access Manager (RAM), AWS Single Sign-On (SSO), AWS Security & Encryption, API keys service access, Best practices for IAM.

Unit - III : Object Storage Services

Traditional Storage, Need to Move to Cloud Storage, Traditional vs. Cloud Storage, Cost CloudStorage, Different Storage Options Available on AWS, Simple Storage Service (S3) and Its Components, Working of S3, Difference Between S3, EBS and EFS, Bucket Policy, Access Control List (ACL), Versioning, Cross-Region Replication (CRR) and Its Use Case, Amazon S3 Transfer Acceleration, Choice of Storage Classes on S3 Lifecycle.

Unit - IV : Amazon EC2

Virtualization, Amazon Elastic Compute Cloud (EC2) and Its Benefits, Amazon Machine Image (AMI), Security Groups in AWS, Authentication through Key-pair, Hardware Tenancy – Shared vs. Dedicated, Networking Layer in EC2: VPC Elastic Network Interface (ENI) and Its Attributes,

Different Categories of IP Address Public IP vs. Elastic IP, Elastic Block Store (EBS) Its Features and Volume Type, Elastic File System (EFS) and Its Features, EBS vs. EFS

Unit - V : Database Services

Amazon RDS and its benefits, Read Replica RDS, IAM Authentication, DynamoDB, ElastiCache: Working, Redis vs Memcached, Amazon RedShift, Kinesis: AWS Kinesis Data Streams, AWS Kinesis Data Firehouse.

Unit - VI: Networking and Monitoring Services

VPC – Benefits and Components, CIDR Notations, Network Access Control List v/s Security Groups, NAT (Network Address Translation): NAT Devices, NAT Gateway and NAT instance, VPC peering Direct Connect Private Link, AWS CloudWatch, AWS CloudTrail, AWS Config.

Course Outcomes

On successful completion of the course, students will be able to:

1. Use Cloud Computing Service of AWS.
2. Work with IAM, Simple Storage Service (S3) and its components.
3. Work with Amazon Elastic Compute Cloud (EC2) services.
4. Write applications to use RDS, VPN and Direct Connect in AWS.

Text books and Reference Books

1. Andreas Witting, Michael Witting, Ben Whaley, Amazon Web Services in Action, secondedition, Dreamtech Press, 2015.
2. Mark Wilkins , Learning Amazon Web Services (AWS): A Hands-On Guide to the Fundamentals of AWS Cloud, First Edition, Pearson, 2019
3. David Clinton, Ben Piper, AWS Certified Solutions Architect Study Guide, Sybex, 2rd edition, 2019.
4. Anthony J. Sequeira, AWS Certified Cloud Practitioner, First Edition, Pearson, 2020.

VI Semester (Honors Scheme)

Department of Computer Science & Engineering

Course Code : CSTH61 **Course : MERN Stack**

L: 4Hrs, T: 0Hrs, P: 0Hrs, Per Week **Total Credits : 04**

Course Pre-requisite

- HTML
- CSS
- JavaScript

Course Objectives

- To establish students as an expert web developer in the MERN stack using this full stack developer course.
- This Full Stack Developer course will establish students as an expert web developer in the MERN stack.
- To implement ReactJS programming in end to end application development.

Syllabus

Module - I : Introduction to Typescript and React

- Introduction to Typescript,
- Typescript Types, programming features such as variables, data types, functions, arrays, classes, interfaces, classes, functions.
- Setup the development environment for working typescript programs.
- Set up the development environment for working with React application.
- Install Visual studio Code IDE for developing React applications.

Module - II : Working with React Js

- Why React?
- Introduction to React.
- React Vs Angular
- Environment Setup
- ES 6 Features
  - Let vs Var
  - Rest & Spread
  - Arrays

- Arrow Functions
- Classes
- Modules

- Components in React
- Introduction to Components
- Functional Components
- Class Components· Defining Component Properties
  - States
  - Props
  - Prop Validation
  - State Vs Props
  - methods available in the React component API.
    - set State ()
    - force Update ()
    - find DOM Node ()
- React Events
  - Handling events in React Componenets.
- React Forms
  - Uncontrolled component
  - Controlled component
- React Router
  - Need of react Router
  - React Router Installation
  - Components in React Router
  - What is Route?
  - Adding Navigation using Link component
- React CSS
  - Inline Styling
  - CSS Style sheet
  - CSS Module
  - Styled Components

- More React Features
  - o Reacts Lists
  - o React Refs
  - o React Table
- Using Redux in Reacts
  - o Introduction to React Redux
  - o What Redux?
  - o Working Redux
  - o Installation of Redux.
  - o React Redux Example

Module - III : Working with Mongo DB Database

- Introduction to the NO-SQL Databases
- Using Mongo command shell
- Create and Drop Database using Mongo command shell
- Create and Drop Collection using Mongo command shell
- Create Documents , understand Data Types
- Query Document
- Update Document
- Delete Document
- Using Mongo Compass
- Create and Delete Database and Collection
- Perform CRUD operation in documents in a collection

Module - IV : Node.js Programming

- Introduction to the Node.js and its features
- Environment Setup, Node Package Manager
- Writing a basic Node.js program
- The package.json configuration file
- Writing Node.js programs using callbacks
- Node.js - Event Emitter
- Node.js - File System
- Introduction to Modules in Nodes.js ; creating and using user defined modules

- Introduction to built-in Node.js modules- http, url , querystring , path, fs
- Integrate Node and MongoDB to perform CRUD Operations programmatically

Module - V : Working with Express.js

- Introduction to the Express.js Framework
- Installing the ExpressJS
- ExpressJs Middleware
- ExpressJS- Routing
- ExpressJs Templating- why emplates, what are templates and how to work with templates
- ExpressJS - Static Files
- Creating RESTful APIs
- Integrate Node, Express and MongoDB

Module - VI : Build end-to-end application

- Integrate all MEAN Stack layers to develop both Front end and Backend applications using all MEAN technology layers. Create a Front-end applications using Angular to perform CRUD operations using Node.js, Express and MongoDB.

Course Outcomes

Upon successful completion of this course, the student will be able to:

1. Create user Interfaces for web development using React framework.
2. Implement database operations using MongoDB Database & Node.JS
3. Design web application to handle API service calls using Express Framework.
4. Develop web applications by integrating front end and backend webtechnology stack.

References

- https://reactjs.org/docs/getting-stared.html
- https://nodejs.org/api/documentation.html
- https://expressjs.com/en/5x/api.html
- https://docs.mongodb.com

VII Semester (Honors Scheme)

Department of Computer Science & Engineering

Course Code : CSTH71 **Course : MERN Stack - 1**

L: 4Hrs, T: 0Hrs, P: 0Hrs, Per Week **Total Credits : 04**

Course Pre-requisite

- MERN Stack
- HTML
- CSS

Course Objectives

- To implement Redux in React for end to end web application development
- Able to implement REST APIs using Express and also testing the Node Server
- To develop application using React Native Programming
- To create a Front-end applications using React to perform CRUD operations using Node.js,Express and MongoDB.

Syllabus

Unit - I : Introduction to Redux in React

- Introduction to React Redux
- What is Redux?
- Working with Redux
- Installation of Redux.
- React Redux Example

Unit - II : Node.js Programming

- Getting started with Node.Js application
- Working with Events, Timers & Callbacks in Node.Js
- Handling I/O in Node.js
- Accessing the File System
- Implementing HTTP Services
- ExpressJs – The Middleware
- Building a Data Model with MongoDB & Mongoose
- Writing REST APIs Using Express
- Consuming REST API
- Managing Authentication and User Sessions
- Testing Node Servers

- Deploy App on Docker and Nginx

Unit - III : Working with MongoDB Database under Node.Js

- Working with MongoDB Atlas database
- Database creation and deletion
- Performing CRUD operations
- Update, Delete and Query documents
- Exploring Mongo command shell

Unit - IV : React native Programming

- Introduction
- Structure & Components
- React Navigation & Resources
- React Animations
- Sample project

Unit - V : Build end-to-end application

- Integrate all MEAN/MERN Stack layers to develop both Front end and Backend applicationsusing all MEAN/MERN technology layers. Create a Front-end applications using React to perform CRUD operations using Node.js, Express and MongoDB.

Course Outcomes

Upon successful completion of this course, the student will be able to:

1. Design web application using Redux in React.
2. Develop web application using Node.js application
3. Work with MongoDB Atlas database
4. Develop web applications using React Framwork

Recommended Books

1] Learning React: A Hands-On Guide to Building Web Applications Using React and Redux, 2E Edition by Kirupa Chinnathambi

2] Node.js, MongoDB & Angular Web Development (Developer's Library) 2E, Brad Dayley

References

- https://reactjs.org/docs/getting-stared.html
- https://nodejs.org/api/documentation.html
- https://expressjs.com/en/5x/api.html
- https://docs.mongodb.com

VIII Semester (Honors Scheme)

Department of Computer Science & Engineering

Course Code : CSTH81 **Course : Big Data Analysis**

L: 3Hrs, T: 0Hrs, P: 0Hrs, Per Week **Total Credits : 04**

Course **Prerequisite**

Course on Operating System, Python/Java Programming

Course Objectives

1. To understand the basic concepts of big data analytics and the Big Data landscape.
2. To explore the ecosystem of Hadoop.

Syllabus

UNIT - I

Introduction to Big Data : Evolution of Big Data, What is Big Data, its types and characteristics, Traditional BI versus Big Data, Data warehouse versus Big data and their co-existence, Consistency

Availability Partition Tolerance (CAP), Basically Available Soft State Eventual Consistency (BASE). Technology Landscape: NoSQL databases: why, advantages, Hadoop: Features, advantages, Hadoop1.0-Hadoop2.0, overview of Hadoop ecosystems.

UNIT - II

Introduction to Hadoop and MongoDB : Hadoop Distributed File System (HDFS), HBase, Hadoop Map-Reduce, Map-reduce way of designing solutions with examples.

NoSQL Databases : NoSQL vs. Relational Database MongoDB: Create Database, Create Collection, Document operations like Insert, update, query, delete, Using JSON, creating and generating a unique key, support for dynamic queries, Data types in MongoDB, CRUD (Create, Read, Update,Delete), Aggregation, Indexing, Sharding, Map-Reduce functions.

UNIT - III

Cassandra : Architecture, Data Replication in Cassandra, Data model: cluster, keyspace, column family, Cassandra Keyspace Operations: Create, Alter, drop, Table Operations: create, alter, drop, truncate, index, CURD Operations, Cassandra CQL: data types, collections.

UNIT - IV

Introduction to Pig- Pig : Data Model, Reading and storing data, Diagnostic Operators, Grouping & Joining, Combining & Splitting, Filtering, Built-In Functions. Pig Vs Hive

Jasper Report using Jasper soft: Jasper Studio: Jasper Reports, Jaspersoft Studio, connecting to mongo DB.

UNIT - V

Introduction to Zoo Keeper - what is Zoo Keeper , Architecture of Zoo Keeper, Nodes in a Zoo Keeper, Zoo Keeper Command Line Interface (CLI), Basics of Zoo Keeper API

UNIT - VI

Machine learning with Big Data : Introduction to Machine Learning with MLlib, Linear and logistic regression, classification and clustering with Big Data tool like Spark.

Course Outcomes

After successful completion of the course students will be able to:

1. Compare traditional approaches to data management with Big Data Analytics.
2. Solve distributed computing challenges with the help of Hadoop Map-Reduce method.
3. Use NoSql Databases for analyzing large data sets.
4. Perform various machine learning tasks using Big data tools.

Text Books

1. Judith Hurwitz, Alan Nugent, Fern Halper, Marcia Kaufman; Big Data for Dummies; Wiley India, 2015.
2. Tom White; Hadoop: The Definitive Guide, 4th Edition, O'Reilly, 2015.
3. Hien Luu; Beginning Apache Spark 2: With Resilient Distributed Datasets, Spark SQL, Structured Streaming And Spark Machine Learning Library, Apress, 2018

Reference Books

1. P. Simon, Too Big to Ignore: The Business Case for Big Data; Wiley, 2015.

IV Semester (Minor Scheme)

Department of Computer Science & Engineering

Course Code : CSTM41 **Course : Data Structures and Algorithms**

L: 4Hrs, T: 0Hrs, P: 0Hrs, Per Week **Total Credits : 04**

Course Objectives

1. To impart to students the basic concepts of data structures and algorithms.
2. To familiarize students on different searching and sorting techniques.
3. To prepare students to use linear (stacks, queues, linked lists) and non-linear (trees, graphs) data structures.
4. To enable students to devise algorithms for solving real-world problems..

SYLLABUS

UNIT - I : Data Structures and Algorithms Basics

Introduction : basic terminologies, elementary data organizations, data structure operations; abstract data types (ADT) and their characteristics.

Algorithms : definition, characteristics, analysis of an algorithm, asymptotic notations, time and space tradeoffs. Array ADT: definition, operations and representations – row-major and column-major.

UNIT - II : Stacks and Queues

Stack ADT : allowable operations, algorithms and their complexity analysis, applications of stacks – expression conversion and evaluation (algorithmic analysis), multiple stacks.

Queue ADT : allowable operations, algorithms and their complexity analysis for simple queue and circular queue, introduction to double-ended queues and priority queues.

UNIT - III : Linked Lists

Singly Linked Lists : representation in memory, algorithms of several operations: traversing, searching, insertion, deletion, reversal, ordering, etc.

Doubly and Circular Linked Lists : operations and algorithmic analysis. Linked representation of stacks and queues, header node linked lists.

UNIT - IV : Sorting and Searching

Sorting: different approaches to sorting, properties of different sorting algorithms (insertion, Shell, quick, merge, heap, counting), performance analysis and comparison.

Searching : Necessity of a robust search mechanism, searching linear lists (linear search, binary search) and complexity analysis of search methods.

UNIT - V : Trees Trees

Basic tree terminologies, binary tree and operations, binary search tree [BST] and operations with time analysis of algorithms, threaded binary trees.

Self-balancing Search Trees: tree rotations, AVL tree and operations, B+-tree: definitions, characteristics, and operations (introductory).

UNIT - VI : Graphs and Hashing

Graphs : basic terminologies, representation of graphs, traversals (DFS, BFS) with complexity analysis, path finding (Dijkstra's SSSP, Floyd's APSP), and spanning tree (Prim's method) algorithms.

Hashing : hash functions and hash tables, closed and open hashing, randomization methods (division method, mid-square method, folding), collision resolution techniques.

Course Outcomes

On completion of the course the student will be able to

1. Analyze the efficiency of algorithms through time and space complexities.
2. Implement different linear data structures (namely stack, queue and linked list).
3. Implement efficient algorithms for searching and sorting.
4. Implement different non-linear data structures (trees and graphs).

Text Books

1. Ellis Horowitz, Sartaj Sahni & Susan Anderson-Freed, Fundamentals of Data Structures in C,Second Edition, Universities Press, 2008.
2. Mark Allen Weiss; Data Structures and Algorithm Analysis in C; Second Edition; Pearson Education; 2002.
3. G.A.V. Pai; Data Structures and Algorithms: Concepts, Techniques and Application; FirstEdition; McGraw Hill; 2008.

Reference Books

1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, and Clifford Stein; Introduction to Algorithms; Third Edition; PHI Learning; 2009.
2. Ellis Horowitz, Sartaj Sahni and Sanguthevar Rajasekaran; Fundamentals of Computer Algorithms; Second Edition; Universities Press; 2008.
3. A. K. Sharma; Data Structures using C, Second Edition, Pearson Education, 2013.

V Semester (Minor Scheme)

Department of Computer Science & Engineering

Course Code : CSTM51 **Course : Software Engineering and Project Management**

L: 4Hrs, T: 0Hrs, P: 0Hrs, Per Week **Total Credits : 04**

Course Objectives

1. To make students a successful professionals in the field with solid fundamental knowledge of software engineering.
2. To prepare students with strong communication and interpersonal skills when functioning as members and leaders of multi-disciplinary teams.
3. To teach students how to apply software development life cycle concepts in readily changing environments using the appropriate theory, principles and processes.

SYLLABUS

UNIT - I

Introduction to Software Engineering, Software Characteristic, Software Myths, Software Engineering- A Layered Technology, Software Process Framework, Software engineering principles: Communication Practices, Planning Practices, Modeling Practices, Construction Practice & Deployment.

UNIT - II

Software Process Models, The Waterfall Model, Linear sequential model, Incremental Process Models, Evolutionary Process Models, Agile Process Models- Scrum, Software requirements: Functional non-functional requirements, User requirement, System requirements, Software requirements Specification.

UNIT - III

An overview, Requirements Analysis, Analysis Modeling Approaches, Data Modeling, Object-Oriented Analysis, Scenario-Based Modeling, Flow-Oriented Modeling, Class-based Modeling, Behavioral Model. Design Engineering Concepts, Design Model, Unified Modeling Language using Star UML.

UNIT - IV

An overview, Unit Testing, Integration Testing, Validation Testing, System Testing, Debugging. Software Testing, Fundamentals, Black-Box Testing, White-Box Testing. Automated testing using selenium.

UNIT - IV

An overview, Software Quality, A Framework for Product Metrics, Software Project management- Plans, Methods and Methodology, Software Effort Estimation- Albrecht Function Point Analysis, Cost Estimation, Project Scheduling using PERT and Gantt charts.

UNIT - VI

Risk management : Risk strategies, Software risks, Risk identification, Risk refinement, RMMM , Change management, configuration management, maintenance tools and techniques, Software Configuration Management SCM Repository, SCM Process.

Course Outcomes

On successful completion of the course, students will be able to:

1. Implement software engineering practices and various models.
2. Apply software engineering processes to modeling and solving real-world problems.
3. Analyze impact of different software testing strategies.
4. Apply approaches to assessment of software quality and management.

Text books and Reference books

1. Roger Pressman; Software Engineering-A Practitioner's Approach; Sixth Edition, McGraw Hill, 2010
2. Ian Somerville; Software Engineering; Seventh Edition; Pearson Education. 2008.
3. Ethics in Information Technology, George W. Reynolds, 4th Edition, Cengage Learning Publication
4. David Gustafsan, Software Engineering; Schaum's Series,Tata McGraw Hill,2002
5. Sanjay Mohapatra; Software Project Management, First Edition, Cengage Learning, 2011.
6. Rajib Mall, Software Project Management, 5th Edition, McGrawHill

VI Semester (Minor Scheme)

Department of Computer Science & Engineering

Course Code : CSTM61 **Course : Artificial Intelligence and Machine Learning**

L: 4Hrs, T: 0Hrs, P: 0Hrs, Per Week **Total Credits : 04**

Course Objectives

1. To understand challenges involved in designing intelligent systems.
2. To represent given problem using state space representation and solve it by using different search techniques.
3. To understand basic concepts of machine learning.
4. To understand and apply artificial neural network to real world problems.
5. To understand and apply probabilistic machine learning to real time problems.

SYLLABUS

UNIT - I

Introduction : Basics of problem solving, problem representation; Search Techniques: Problem size, complexity; Uninformed search techniques- Depth, Breadth, Uniform Cost, Depth Limited, Iterative deepening DFS.

UNIT - II

Informed search techniques : Heuristic Based Search, Greedy Based First Search, A* Search; Local Search algorithms: Hill-climbing, Simulated Annealing, Genetic Algorithms.

UNIT - III

The concept learning task, General-to-specific ordering of hypotheses. Version spaces. Inductive bias. Decision Tree Learning. Rule Learning: Propositional and First-Order, Over-fitting, Cross-Validation. Experimental Evaluation of Learning Algorithms.

UNIT - IV

Instance-Based Learning : k-Nearest neighbor algorithm, Radial basis functions. Case- based learning, K-means and Hierarchical Clustering.

UNIT - V

Artificial Neural Networks : Linear threshold units, Perceptions, Multilayer networks and back-propagation, recurrent networks.

UNIT - VI

Probabilistic Machine Learning : Maximum Likelihood Estimation, MAP, Bayes Classifiers Naive Bayes, Bayes optimal classifiers, Minimum description length principle.

Course Outcomes

On successful completion of the course, students will be able to:

1. Represent given problem using state space representation.
2. Apply uninformed and informed search techniques on it.
3. Analyze learning systems in Artificial Intelligence.
4. Apply uncertainty theory based on techniques like probability theory in AI and Machine Learning system.

Text Books

1. Stuart Russel and Peter Norvig; Artificial Intelligence: A Modern Approach; Third Edition;Pearson Education, 2009
2. Tom Mitchell; Machine Learning – an Artificial Intelligence Approach, Volume-II
3. Ethem Alpaydin; Introduction to machine Learning, Third Edition

VII Semester (Minor Scheme)

Department of Computer Science & Engineering

Course Code : CSTM71 **Course : Mobile Application Programming**

L: 4Hrs, T: 0Hrs, P: 0Hrs, Per Week **Total Credits : 04**

Course Objectives

1. To learn and understand the characteristics of mobile computing and mobile infrastructure and data storage mechanisms.
2. To understand user interface design issues and know different mobile platforms.
3. To design and build the applications for the Android devices.

SYLLABUS

UNIT - I : Introduction to Mobile Application Development

Mobile Computing Technologies: An Overview, Mobile Devices, History, Web vs. Native, Wireless Access Protocol, Content vs. Applications, Cellular Networks, CDMA, GSM, 3G Network and Services, 4G.

UNIT - II : Designing Mobile User Interfaces

Mobile User Experience Design, Task Analysis and Contextual Inquiry, Development Cycle, Rapid Prototyping, Mobile User Interface Types, Interactive Voice Response (IVR), SMS/MMS, Mobile Web, Native Applications, Hybrids, Text Entry, Screen Size, Mobile Platforms URIs for Mobile Apps, Cross Platform Development.

UNIT - III : Introduction to Android

History, Android Application Development Environment, Architecture of Android, App Development Approaches, Anatomy of android app, UI Resources: Activity, Viewgroups, View: Basic Views, Picker Views, List Views and event handling mechanisms.

UNIT - IV : Intents

Linking activities, calling built in apps, Intent Filters, Toast, Notifications, Dialog, Image Views, creating menu with views.

UNIT - V : Threads

Threads, Async Task, Content Provider, Broadcast Receivers, persisting data to files, creating and using databases.

UNIT - VI : Services

Services, Messaging, SMS messaging, Sending email, Location Based Services, displaying maps, getting location data, developing android services.

Course Outcomes

On completion of the course the student will be able to

1. Design the infrastructure for mobile computing applications.
2. Design mobile apps with key focus on user experience design.
3. Implement Android application for data storage, retrieval, preferences, files, databases, and content providers using different Android's APIs.
4. Develop applications for networking, location awareness and multimedia for Android devices..

Text Books

1. Beginning Android Programming with Android Studio, 4Ed by J. F. DiMarzio, Wrox publication.
2. Beginning Android- 4.0 Application Development by Wei-Meng Lee , Wiley publication..

Reference Books

1. Beginning Android Programming: Develop and Design by Kevin Grant and Chris Haseman, Peachpit Press.
2. Professional Android 4 Application Programming by Reto Meier, Wiley Publication

Reference Book

3. Android Programming for Beginners - Second Edition by John Horton, Packt Publishing Pvt. Ltd.
4. Wireless Communication and Networks, 2nd Edition by William Stallings, Prentice Hall 2005.

VIII Semester (Minor Scheme)

Department of Computer Science & Engineering

Course Code : CSTM81 **Course : Database Management Systems**

L: 4Hrs, T: 0Hrs, P: 0Hrs, Per Week **Total Credits : 04**

Course Objectives

1. To understand the role of a database management system in an organization.
2. To construct simple and advanced database queries using a data language.
3. To understand and apply logical database design principles and database normalization.
4. To recognize the need for transaction management and query processing.

SYLLABUS

UNIT - I : Introduction to Database System Concepts and Architecture

Databases and Database Users, Characteristics of the Database Approach, Advantages of Using the DBMS Approach, When Not to Use a DBMS, Data Models, Schemas, and Instances, Three-Schema Architecture and Data Independence, Database Languages and Interfaces, The Database System Environment. Introduction to NoSQL databases and In-Memory databases.

UNIT - II : The Relational Data Model and SQL

Relational Model Concepts, Relational Model Constraints and Relational Database Schemas, Update Operations, Transactions, and Dealing with Constraint Violations, SQL Data Definition, Data Types and Constraints, Data Management in SQL, Transforming ER Model into Relational Model.

UNIT - III : Database Design and Normalization

Functional Dependencies, Inference Rules, Equivalence, and Minimal Cover, Properties of Relational Decomposition, Normal Forms Based on Primary Keys, General Definitions of Second and ThirdNormal Forms, Boyce-Codd Normal Form, Other Dependencies and Normal Forms.

UNIT - IV : Indexing and Hashing

Ordered Indices, B+-Tree Index Files and its Extensions, Static Hashing and Dynamic Hashing, Comparison of Ordered Indexing and Hashing, Bitmap Indices, Some General Issues Concerning Indexing.

UNIT V Query Processing and Optimization

Measures of Query Cost, Query Operation: Selection, Sorting and Join Operation, Transformation of Relational Expressions, Estimating Statistics of Expression Results, Choice of Evaluation Plans.

UNIT - VI : Transaction Processing, Concurrency Control and Recovery

Introduction to Transaction Processing, Characterizing Schedules Based on Recoverability, Characterizing Schedules Based on Serializability, Two-Phase Locking Techniques for Concurrency Control, Deadlock Handling and Multiple Granularity, Database Recovery Techniques.

Course Outcomes

On completion of the course the student will be able to

1. Model data requirements for an application using conceptual modeling tools.
2. Design database schemas by applying normalization techniques.
3. Execute efficient data storage and retrieval queries using SQL.
4. Use concurrency control and database recovery in transaction management.

Text Books

1. Abraham Silberschatz, Henry F. Korth and S. Sudarshan; - Database System Concepts, Sixth Edition, Tata McGraw Hill, 2011.
2. Ramez Elmasri and Shamkant Navathe; - Fundamentals of Database Systems, Sixth Edition, Addison Wesley 2011.

Reference Books

1. Raghu Ramakrishnan and Johannes Gehrke; - Database Management Systems; Third Edition; Tata McGraw Hill Publication, 2003.
2. C. J. Date; - Database in Depth – Relational Theory for Practitioners; O`Reilly Media, 2005.